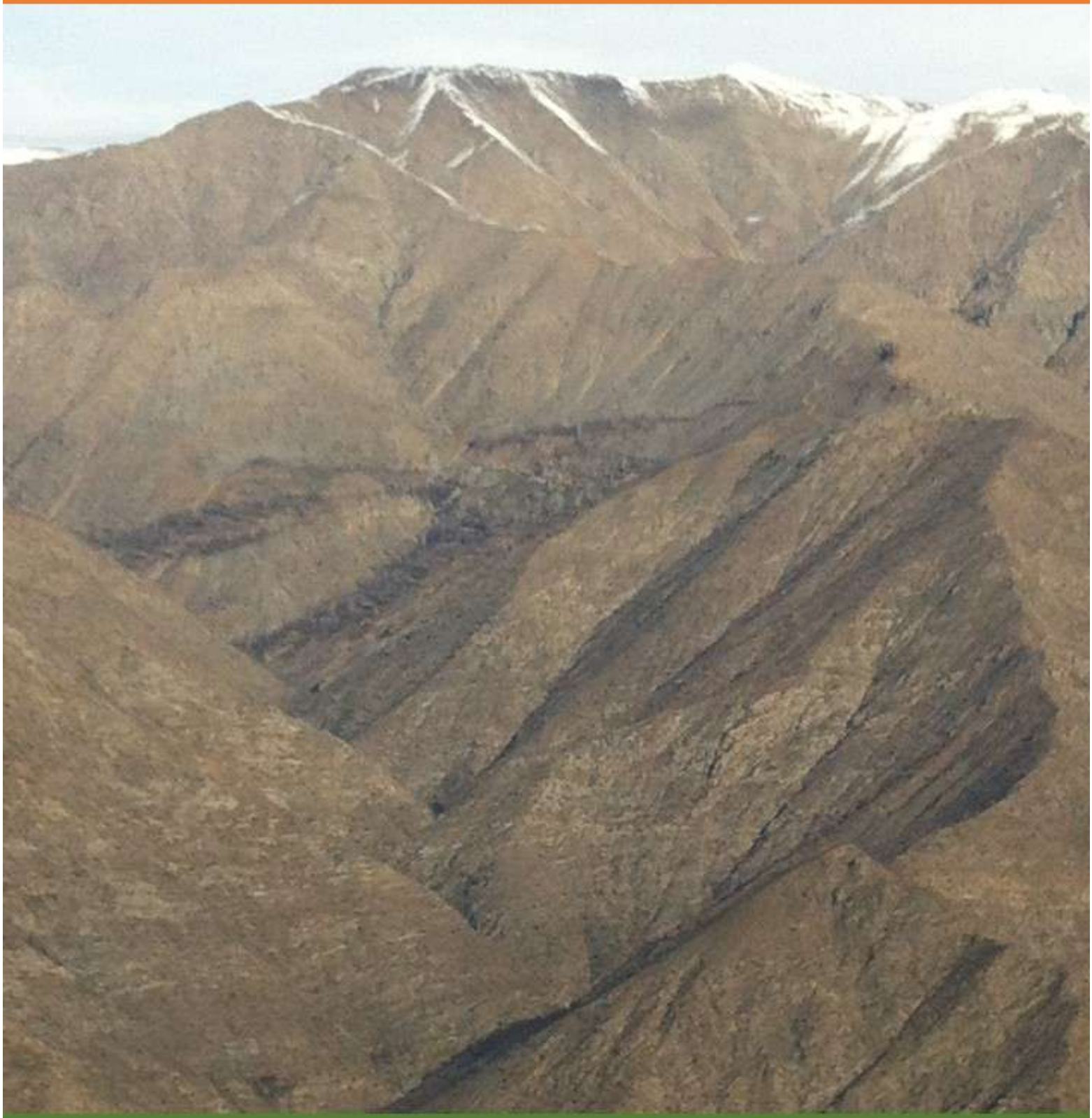
Eurasian Journal of Forest Science

Volume 11 Issue 2 June 2023



ISSN: 2147-7493

Eurasian Journal of Forest Science

ISSN: 2147 - 7493

Cover Page
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Journal Web Page

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Eurasian Journal of Forest Science

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ISSN: 2147 - 7493

Issue 11, Number 2, 2023

Contents

Eurasian Journal of Forest Science

2023 11(2): 23-24

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

Corrigendum to "An assessment of consumer demand for medicinal plants: A case of Istanbul" Eurasian Journal of Forest Science , 11 (1) , 1-13 . DOI: 10.31195/ejejfs.1243329

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Abstract
Non-wood forest products (NWFPs) are collected or harvested for commercial and medical purposes from forests. These plants can be diversified into wild food plants, medicinal and aromatic plants, bulbous plants, mushrooms, dye plants and honey. The aim of this study is to assess the demand of consumers who buy medicinal plants in Istanbul and to reveal the relationships between the variables affecting the demand. For this purpose, face-to-face interviews were conducted with consumers (n=384) who purchased medicinal plants in 20 randomly selected districts of Istanbul. Descriptive analysis, correlation analysis and Chi-square independence test were used in data analysis. These analyses were carried out with the SPSS 22.0 statistical package program. According to the results, the most demanded medicinal plants are *linden, mint and ginger*, respectively. People buy medicinal plants mostly for the treatment of *respiratory system* and *digestive system diseases* and the demand is generally high in *winter* and *autumn*. The most important factor affecting the purchasing preferences of consumers is *freshness*. The consumers mostly buy the medicinal plants from *herbalists*. According to the Chi-square analysis findings, there is a significant relationship between the gender of consumers and the purpose of using medicinal plants. In addition, while there was no relationship between gender and price, brand, quality, there was a statistically significant relationship between expiration date and visuality.
Keywords: Non-wood forest products, medicinal plants, demand, consumer, Istanbul.

This is a corrigendum for the paper cited as: "Özkan, O. & Deniz, T. (2023). An assessment of consumer demand for medicinal plants: A case of Istanbul . Eurasian Journal of Forest Science , 11 (1) , 1-13 . DOI: 10.31195/ejejfs.1243329"

The Acknowledgement of previous version was as:

"Acknowledgement: This article is a summary of a part of Master of Science thesis titled "Tıbbi ve aromatik bitkilerin talebi üzerine araştırmalar: İstanbul örneği" prepared by Özkan (2019) under the supervision of Tuğba Deniz."

It has been corrected as:

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It is corrected as: "Özkan, O. (2019). Tıbbi amaçlı kullanılan odun dışı orman ürünlerinin talebi üzerine araştırmalar: İstanbul örneği, İstanbul Üniversitesi-Cerrahpaşa, Lisansüstü Eğitim Enstitüsü, Yüksek Lisans Tezi, İstanbul."

Original Article was Submitted: 27.01.2023
Accepted: 20.02.2023

Corrrigendum has been submitted: 17.08.2023
Accepted: 18.08.2023

Eurasian Journal of Forest Science

2023 11(2): 25-35

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

Some seed characteristics and genetic similarities of Western Black Sea Fir populations including an isolated population

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Abstract: West Blacksea fir (*Abies nordmanniana* (Stev.) Spach subsp. *equi-trojani*) is an endemic species of Turkey. Six populations, four of which are a seed stand and three gene conservation forests (Akyazi-Dokurcun, Aladag-Sarialan, Kizilcahamam-Guvem, Safranbolu-Safranbolu), a Nature Reserve Area (Istanbul-Beykoz) and a natural forest (Pinarbasi-Kurtgirmez) were selected to study. Cones were harvested from 118 trees in six populations. Some seed characters obtained from cones were measured and evaluated. The average seed width, length, and thickness were 6.63 mm, 12.06 mm, and 3.46 mm, respectively. The average 1000 seed weight was 82.80 g. Statistical analyses indicated significant differences at the population level in all characteristics except seed length. Regarding genetic similarity, populations were divided into two main groups: East and West. The isolated Istanbul-Beykoz population was similar to the West group showing artificial migration or cut-off from the West group. Due to including seed stand and gene conservation forest, the findings are expected to contribute to forest management, besides Christmas trees and landscape use.

Keywords: Seed width, seed thickness, seed length, 1000 seed weight, gene conservation

Introduction

The forests of Turkey are very rich in terms of the number of species. In addition, a significant part of the natural species that make up forests is endemic. In addition to the importance that endemic species bring to the country's flora, a responsibility is required for forestry practices to be made for these species. Since two of the four fir taxa in Turkey are endemic, research studies to be carried out with fir taxa will supply knowledge and enable better implementations over firs thanks to knowledge. The ornamental use (Bilgili et al., 2012; Sakıcı et al., 2012), Christmas trees (Kurt et al., 2016; Nielsen et al., 2020), and consisting of approximately of raw material % 10 of total industrial wood production between 2000 and 2021 in Turkey (OGM, 2023) also increases research over firs

Firs, which are included in the *Coniferae* class of the *Pinaceae* family, are represented by 48-49 species in North and Central America, Asia, Europe, and North Africa (Farjon, 2010). Alizoti et al. (2011) stated that 10 fir taxa are distributed in the Mediterranean, two of which are in North Africa (Figure 1), including Turkey's fir *(Abies. cilicica* subsp. *cilicica and* subsp. *isaurica, Abies nordmanniana* subsp. *equi-trojani*,

subs. *nordmanniana, and* subs. *bornmülleriana)* (Farjon, 2010). However, the fir species was revised (Akkemik 2020). In this revision, no change was made for *Abies cilicica*. *Abies nordmanniana* (Stev.) Spach subsp. *nordmanniana (*Eastern Black Sea Fir*)* and *Abies nordmanniana* (Stev.) Spach subsp.*equi-trojani* (Western Black Sea Fir), were renamed. With this revision, *Abies nordmanniana* subsp. *bornmülleriana* (Uludağ Fir) and *Abies nordmanniana* subsp. *equi-trojani* (Kazdag Fir) were combined into a subspecies (Western Black Sea Fir).

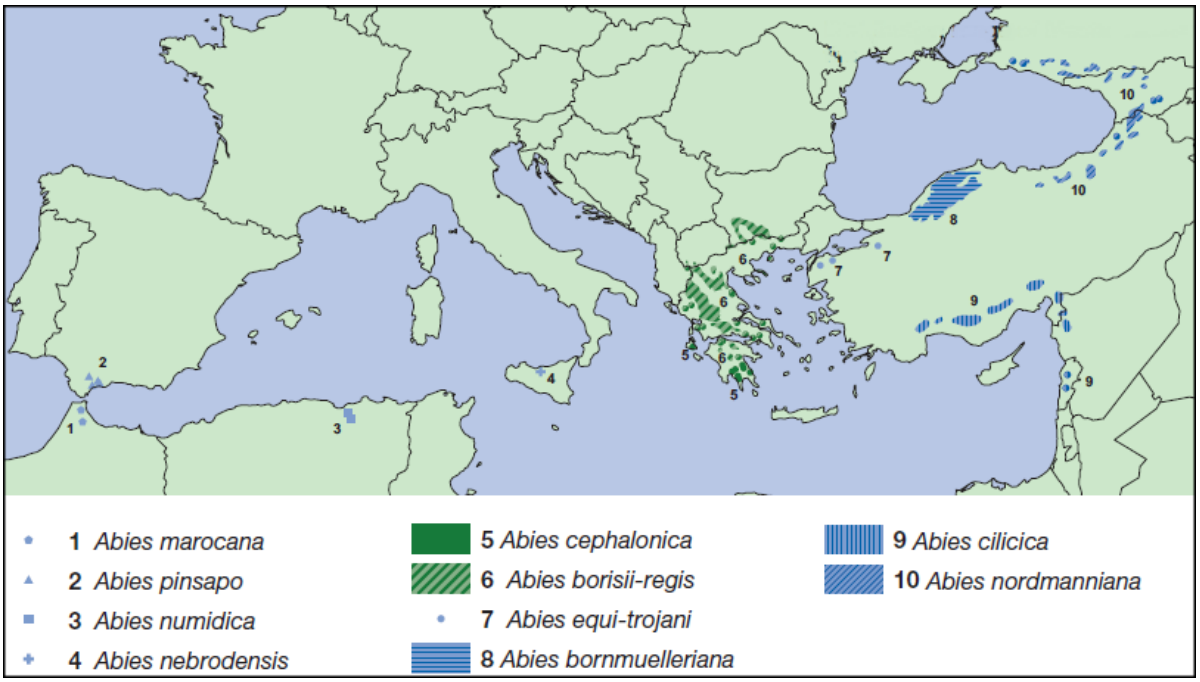

Figure 1. Distribution of firs' taxa in the Mediterranean Region (Alizoti et al., 2011)

Western Black Sea Fir (*Abies nordmanniana* (Stev.) Spach subsp. *equi-trojani*), which is endemic among the fir taxa, is an economically significant forest tree for Turkey that can grow up to 30-40 meters in height and up to 1.4 meters in diameter. It distributes between the Western Black Sea Basin and Kocaeli Basin, from Bafra, where the Kizilirmak reaches into the sea, to Uludağ, in the north of our country, at an altitude of approximately 1000-2000 meters (Figure 1). In addition, there is an isolated population of 46.5 hectares in Istanbul Beykoz at an altitude of 180 meters.

Genetic diversity in a species can be achieved by revealing the characteristics of populations in different habitats and comparing this information (Chmura and Rozkowski, 2002). Fir forests have unique genetic resources due to their evolutionary history and special adaptations. On the other hand, it is reported that its protection is necessary due to the threats arising from its endemism characteristics and scattered distribution. In this context, it is stated that the gene sources of Mediterranean firs are of particular importance (Alizoti et al., 2011; Caudullo and Tinner, 2016).

A seed contains an embryo formed by sexual reproduction and transforming into the next generation of plants. The seed occupies a critical position in the life history of the higher plant. The success with which the new individual is established -the time, the place, and the vigor of the young seedling—is primarily

determined by the physiological and biochemical features of the seed (Bewley et al., 2013). Researching seed characteristics is an effective way in population studies (Moreno-Saiz et al., 2003). Regarding 1000 seed weights, one of the seed characteristics, fast new methods were researched due to the importance of the commercialization process, directing storage, sowing, and germination (Felix et al., 2021). Seed source variations concerning cone, seed, and seedling characteristics were well-documented for several tree species (Isik, 1986; Dvorak et al., 1996; Rawah and Bakshi, 2011). In addition, it is claimed that seed production is a crucial stage in a plant's life history, and seed traits can directly affect plant fitness and persistence (Cochrane et al., 2015; Wu et al., 2018).

On the other hand, as phenotypic variation can benefit plants' adaptation to heterogeneous environments, variation in seed traits may increase this species' fitness and facilitate its persistence under future climate change (Wu et al., 2018). In this context, a description of the population's genetic structure and distribution of genetic variation among populations in this species is necessary for decisions regarding tree breeding and the conservation of plant genetic resources (Rawah and Bakshi, 2011). Moreover, further research that integrates ecology and emerging evolutionary genetic techniques to identify the distribution of seed traits within foundation species and the mechanisms driving them is emerged to guide the management and maintenance of systems in the face of rapidly changing climates (Cochrane et al., 2015).

Some studies were carried out on seed and seedling characteristics of fir species (Turna et al., 2010; Velioğlu et al., 2012; Kurt et al., 2016; Yüksel and Dirik, 2021). However, unlike the studies mentioned, some seed sources (seed stand and gene conservation forest) and the Pinarbasi-Kurtgirmez population which represents one of the regions where the Western Black Sea Fir is widely distributed, were included in this research. Another dimension that makes this study quite different (unique) from the earlier studies is that the Istanbul-Beykoz population, which spreads outside the fir distribution area and is registered as a Nature Conservation Area (TKA), is also the subject of the study. The isolated or “island” population is in Istanbul Province, Beykoz District, and the only fir naturally distributed in the region, rare and under threat due to its characteristic of a forest ecosystem (Urker, 2021). Revealing the variation of populations, including an isolated population, using seed characteristics for Western Black Sea Fir was considered valuable for contributing to tree breeding and gene conservation.

This study aimed to reveal the seed characteristics of endemic Western Black Sea Fir populations, expose the relationships between the populations, including isolated population, and link their effects on geographical distributions using seed characteristics. Besides managing the firs population, findings also have the potential to be used in landscape implementation and the growing of noel trees due to the properties of Western Black Sea fir.

Material and Method

Material

An isolated population, Istanbul-Beykoz, and five populations in natural distribution (Akyazi-Dokurcun, Aladag-Sarialan, Kizilcahamam-Guvem, Safranbolu-Safranbolu, and Pinarbasi-Kurtgirmez) including seed stands and gene conservation forests of Western Black Sea Fir were studied (Table 1, Figure 2).

Table 1. Sampled West Black Sea fir poulations

Populations	Latitude	Longitude	Altitude	Aspect	Status
Istanbul-Beykoz	41° 09' 26"	29° 05' 54"	180	GD	TKA*
Akyazi-Dokurcun	40° 37' 30"	30° 51' 00"	1300	GD-GB	TM**
Aladag-Sarialan	40° 39' 26'	31° 46' 03"	1650	D	GKO***
Kizilcahamam-Guvem	40° 37' 08"	32° 46' 31"	1800	D	GKO
Safranbolu-Safranbolu	41° 20' 04"	32° 36' 11"	1700	D	GKO
Pinarbasi-Kurtgirmez	41° 34' 02"	33° 12' 30"	1150	K	Natural forest

*TKA, Nature Protection Area **TM: seed stand ***GKO, Gene Conservation Forest

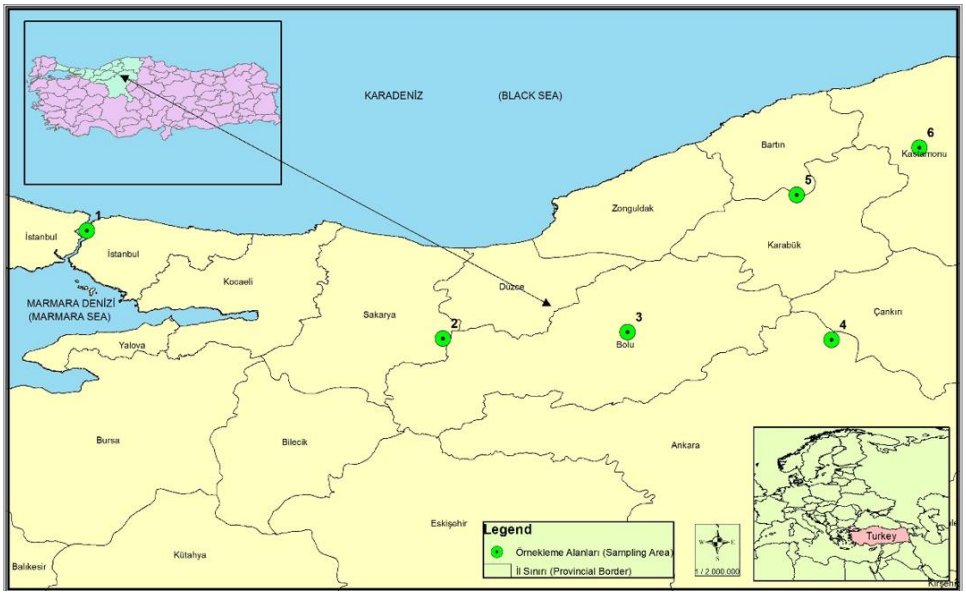

Figure 2. Location of sampled populations (1, Istanbul-Beykoz; 2, Akyazi-Dokurcun; 3, Aldag-Sarialan; 4, Kizilcahamam-Guvem; 5, Safranbolu-Safranbolu; 6, Pinarbasi-Kurtgirmez)

Method

After selecting 20 families (trees) from each population (18 families from the Istanbul-Beykoz population), twenty cones from each family were collected between September 15 and October 20. The total number of families collecting cones from six populations was 118. The trees from which the cones would be collected were considered at least 100 m away from each other (approximately twice the seed drop distance), the altitude difference between the trees was at most 300 m, and the tree ages were close to each other. After the collected cones were placed separately in labeled bags containing the necessary information for each tree, the mouths of the bags were opened under room conditions, and the bags were aerated. Cones were threshed (mixed) daily against mold and spoilage, and seeds were obtained on a family basis. Before starting the measurements, the seeds were blown, and the empty and rotten ones were removed.

A digital caliper was used for seed size measurements with 0.01 mm sensitivity. The dimensions of the seeds extracted from 20 cones collected from each tree and a total of 118 x 20=2360 cones were measured, and the weight of 1000 seeds was found for 118 trees. The length of the seeds for each tree was measured in millimeters, its width was measured in millimeters from its widest point and perpendicular to its long axis,

and its thickness (mm) was measured from the thickest part of the seed. 1000 seed weight was calculated using ISTA (2017).

The collected data were analyzed in SPSS 16.0 statistical package program. If the differences between the groups were statistically significant in the analysis of variance, the Student Newman Keuls (SNK) test was applied to determine different groups. In addition, correlations between characters and characters with altitude, latitude, and longitude were estimated. Lastly, the similarity tree was created using the furthest neighborhood method after the Z transform to the characters.

The following statistical model used for variance analysis.

$$y_{ij} = \mu + P_i + e_{ij}$$

Where y_{ij}; is observation in j^{th} *tree*, on the i^{th} population, μ; general mean, P_i is i^{th} population (i= 1, 2…, 6), e_{ij} is experimental error.

Results and Discussion

The seed width of six Western Black Sea Fir populations ranged between 5.32-8.02 mm, and the average was 6.63 mm. In the same order, seed length 10.65-14.01 mm and 12.06 mm, seed thickness 2.93-4.05 mm and 3.46 mm, and 1000 seed weight 41.45-132.75 g and 82.80 g was found (Table 2). On the other hand, the coefficients of variation varied between 6% and 18%. Turna et al. (2010) reported 5.81 mm, 11.35 mm, and 3.88 mm for seed width, length, and thickness, respectively. Similarly, 6.51 mm, 11.99 mm, and 3.41 mm for Western Black Sea fir were found by Velioğlu et al. (2012). Our research findings were similar to Turna et al. (2010) and Velioğlu et al. (2012); however, the seed width and length were high, albeit slightly. Similarity can be seen in 1000 seed weights, 82,95, and 82.13 g, as found by Turna et al. (2010) and Velioğlu (2012).

Table 2. Basic statistics of seed traitss

Characters	N	Ortalama±se*	Standard deviation	Coefficient of variation (%)	Min.	Max.
Seed width (mm)	118	6,63±0,4	0,44	7	5,32	8,02
Seed length (mm)	118	12,06±0,07	0,72	6	10,65	14,01
Seed thickness (mm)	118	3,46±0,02	0,22	6	2,93	4,05
1000 seed weight (g)	118	82,80±1,36	14,78	18	41,45	132,75

*se, standard error

The Istanbul-Beykoz populations at the lowest elevation were the highest 1000 seed weight (Figure 3). When the Istanbul-Beykoz population was excluded, the 1000 seed weight of the Pinarbasi-Kurtgirmez population at the lowest elevation (1150 m) was the lowest 1000 seed weight. Except for the Beykoz population, which is at a very low altitude compared to the distribution altitude of the species, an increase in 1000-seed weight was observed as the altitude increased. However, the 1000 seed weight in the Kızıılcahamam-Guvem population (1800 m) with the highest elevation reversed this trend and approached the Akyazi-Dokurcun population at the lowest elevation. However, Istanbul-Beykoz, an isolated (island) population, has the highest 1000 seed weight; there was no trend with altitude and 1000 seed weight of Western Black Sea Firs.

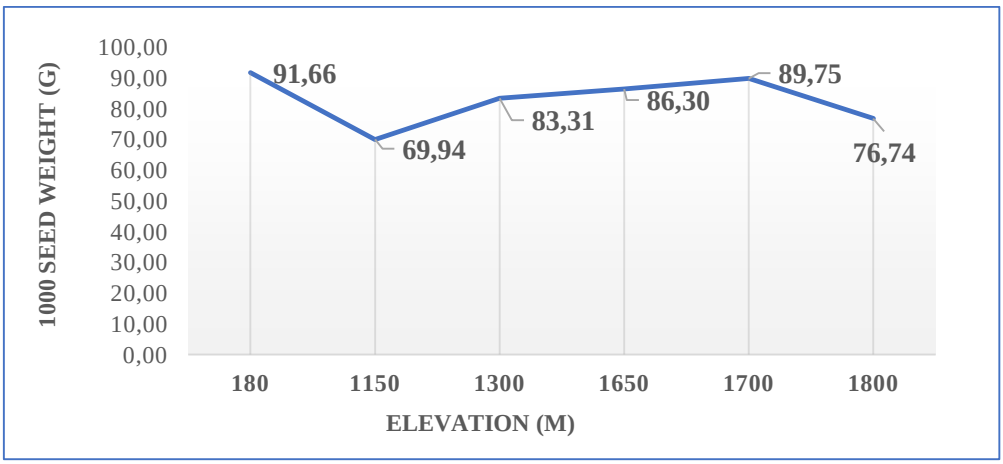

Figure 3. The changing 1000 seed weight with elevation

When the seed sizes were evaluated by the elevation (Figure 4), Pinarbasi-Kurtgirmez had the highest value in seed width, and Akyazi-Dokurcun and Istanbul-Beykoz populations had the lowest value. However, there is no apparent trend in seed width concerning elevation. A trend in seed thickness and length related to altitude was also observed.

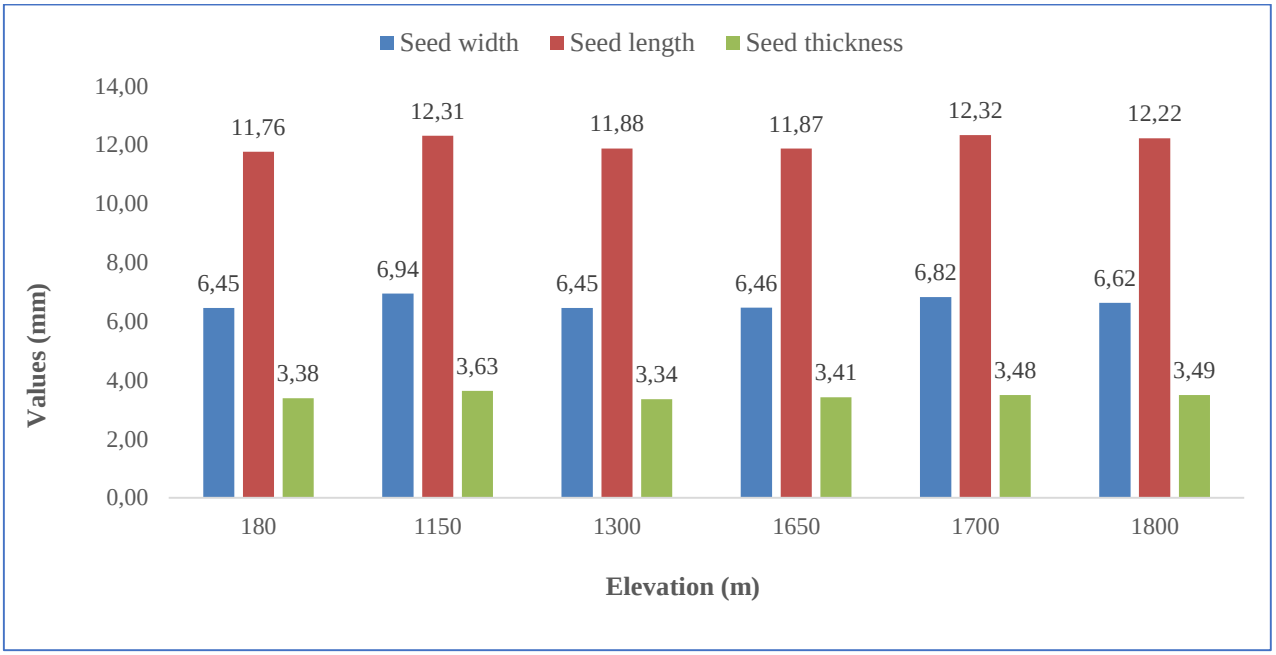

Figure 4. Altitude versus seed of width, length and thickness

In the analysis of variance at the population level for the four characters, statistically significant differences were found in seed width, seed thickness, and 1000 seed weight, while the difference was statistically insignificant for seed length (Table 3).

Table 3. ANOVA for seed characters for populations

Sources of variation	Degree of freedom	Mean squares			
		Seed width	Seed lengt	Seed thickness	1000 seed weight
Population	5	0,88***	1,24^{ns}	0,21***	1334,35***
Error	112	0,16	0,54	0,04	168,63

ns, non-significant; ***, p>0.001

Different groups were determined by using the SNK multiple comparison test for characters where differences between populations were significant (Table 4). Although the groups were intertwined, the Pinarbasi-Kurtgirmez population reached the highest values regarding seed sizes, while the same population had the lowest 1000 seeds weight. Seed characteristics can be decisive regarding species differentiation. In this context, Velioğlu et al. (2012) studied the seed characteristics of the fir species distributed in Turkey, showing that a species-based distinction could be made according to the seed characteristics. Kaliniewicz et al. (2019) also found that 11 fir species differed primarily in seed length and weight. In addition to species, for seed length, width, thickness, and 1000 seed weight, high statistical differences were revealed in 20 populations of *Pinus wallichiana* (Rawat and Bakshi, 2011), and Wu et al. (2018) also found significant differences in seed length, width, and mass in 11 populations of *Euptelea pleiospermum*. Therefore, it is claimed that populations can reflect their differences, including their geography, climate, and genetic structures, to seed characteristics (Morgenstern, 1996; Ducci et al., 2012; Dixit and Kolb, 2020; Dixit et al., 2020)

Tablo 4. SNK multiple comparison test for populations

Populations	Seed width	Seed lengt	Seed thickness	1000 seed weight
Pinarbasi-Kurtgirmez	**6,94 a**	12,30	**3,60 a**	69,93 c
Safranbolu-Safranbolu	6,82 ab	12,32	3,48 ab	**89,75 a**
Kizilcahamam-Guvem	6,62 bc	12,22	3,49 ab	76,74 bc
Aladag-Sarialan	6,46 c	11,87	3,41 b	86,30 ab
Istanbul-Beykoz	6,45 c	11,75	3,38 b	**91,66 a**
Akyazi-Dokurcun	6,45 c	11,88	3,34 b	83,31 ab

Populations showed different attitudes related to each seed character. The Akyazi-Dokurcun population had low values in terms of seed size; however, it was in the middle with a 1000-seed weight. Istanbul-Beykoz and Safranbolu-Safranbolu populations reached the highest 1000-seed weight. The fact that these two populations are in a different order regarding seed size indicates no significant relationship between seed size and 1000-seed weight. There may be various reasons for the current study's high or low 1000 seed weight in populations. For example, Keskin and Şahin (2000) found that the 1000 seed weight in Taurus fir was 139.1 g in a poor seed year and 226.0 g in a mass seed year. Therefore, common garden tests can be better for supporting the seed characteristics of populations, although the findings show population differences in seed character.

On the other hand, seed weight is an essential life-history trait with effects on offspring phenotype and ultimately on fitness over germination, early growth, survival, abiotic stress tolerance, and biotic resistance for coniferous (Sorensen and Campbell, 1993; Wennstromet al.,2002; Parker et al., 2006; Blade and Vallejo, 2008; Zas and Sampedro, 2015; Chen et al., 2022). In this context, Beykoz and Safranbolu populations have more advantages in adaptation. These findings on seed weight supports to assigned as the natural reserve of Istanbul-Beykoz and the gene conservation forest of the Safranbolu-Safranbolu population.

The populations were subjected to the analysis of variance in terms of aspect, and there was no significant difference between the populations in terms of seed length. In contrast, a high level (p>0.001) statistical difference was observed between the populations in the other three characteristics (Table 5).

Tablo 5. ANOVA for seed characters for aspects

Sources of variation	Degree of freedom	Mean squares			
		Seed width	Seed lengt	Seed thickness	1000 seed weight
Aspect	3	1,041***	1,51^{ns}	0,322***	1699,599***
Error	113	0,168	0,63	0,041	181,604

ns, non-significant; ***, p>0.001

SNK multiple comparison tests were performed for aspects using seed characteristics (Table 6). In this comparison, the sunny aspects (SE-SW, E, SE) seed sizes are smaller than the shadow aspects (N). In contrast, the sunny aspects (SE-SW, E, SE) 1000 seed weights were higher than the shadow aspect (N). However, while there are three populations in the sunny aspect of our study, there is one in the shadow aspect. On the other hand, Demir (2019) also reported that the seeds of the populations in the sunny aspect were heavier than in the shadow aspect in Juniperius excalsa M.Bieb. Therefore, the study showed Western Black Sea Firs produced heavier seeds in sunny aspects.

Tablo 6. SNK multiple comparison test for aspect of populations

Aspect	Seed width	Seed Lengt	Seed thickness	1000 seed weight
N	**6,94 a**	12,30	**3,63 a**	69,93 b
SE-SW	6,44 b	11,87	3,34 b	**83,31 a**
E	6,63 b	12,13	3,46 b	**84,26 a**
SE	6,45 b	11,75	3,38 b	**91,65 a**

N, North; SE, Southeast; SW, Southwest; E, East; SE, Southeast

The correlations between geographical factors (latitude, longitude, and altitude) with the four seed characters and among characters are given in Table 7. While there was a statistically significant and moderate correlation between seed width and seed length (0,58) and between seed width and seed thickness (0,61), and between seed length and seed thickness (0,57), other correlations were low despite sometimes being statistically significant. In this context, there were moderate and low correlations among characters and between characters and the geographic conditions of the population. Rawat and Bakshi (2011) also found low and statistically insignificant correlations between seed characters (seed length, width, thickness, and 1000 seed weight) and locations (altitude, latitude, and longitude). However, Kaliniewicz et al. (2019) found a similar correlation between characters like our study.

Tablo 7. Correlations with geographical factors (altitude, latitude and longtitute) and among characters

Characters	Seed width	Seed Lengt	Seed thickness	1000 seed weight
Seed width				
Seed length	0,58**			
Seed thickness	0,61**	0,57**		
1000 seed weight	0,06^{ns}	0,25**	0,18*	
Altitude	0,11^{ns}	0,17^{ns}	0,09^{ns}	-0,13^{ns}
Latitude	0,32**	0,14^{ns}	0,26**	-0,03^{ns}
Longtitude	0,36**	0,29**	0,36**	-0,35**

ns, non-significant; *, 0.05; **, 0.01,

The similarity tree (cluster), which was created by using the characteristics observed in the study (seed width, length, thickness, and 1000 seed weight), was first divided into two groups (Figure 5). Aladag-Sarialan, Akyazi-Dokurcun, and Istanbul-Beykoz populations were included in the first group, while the second group consisted of Safranbolu-Safranbolu, Kizilcaham-Guvem, and Pinarbasi-Kurtgirmez. While the first group populations are located very close to each other for similarity, the second group is separated into the cluster. When the cluster was associated with the geographical location, it was seen to be divided into the "western group" (Aladag-Sarialan, Akyazi-Dokurcun, and Istanbul-Beykoz), and the "eastern group" (Safranbolu-Safranbolu, Kizilcahamam-Guvem, and Pinarbasi-Kurtgirmez). The isolated population (Istanbul-Beykoz) was in the western group and showed similar seed characteristics with Aladag-Sarialan and Akyazi-Dokurcun. It is seen that the genetic distances of the western group were closer to each other and, therefore, more similar to each other than the eastern group. In addition, these results showed that the Istanbul-Beykoz population, which has an isolated population, may have been detached from the western group or could have been artificially transported. Due to the threats, endemism, and geographically scattered distribution, conserving Mediterranean firs and their genetic resources is a major challenge (Alizoti et al., 2011). In this context, our findings showed that seeds should not be transferred between the west and east group and used local seed sources. At the same time, our findings support before studies on gene conservation forests (Aladag-Sarialan, Kizilcahamam-Guvem, and Safranbolu-Safranbolu) and the natural reserve, Istanbul-Beykoz.

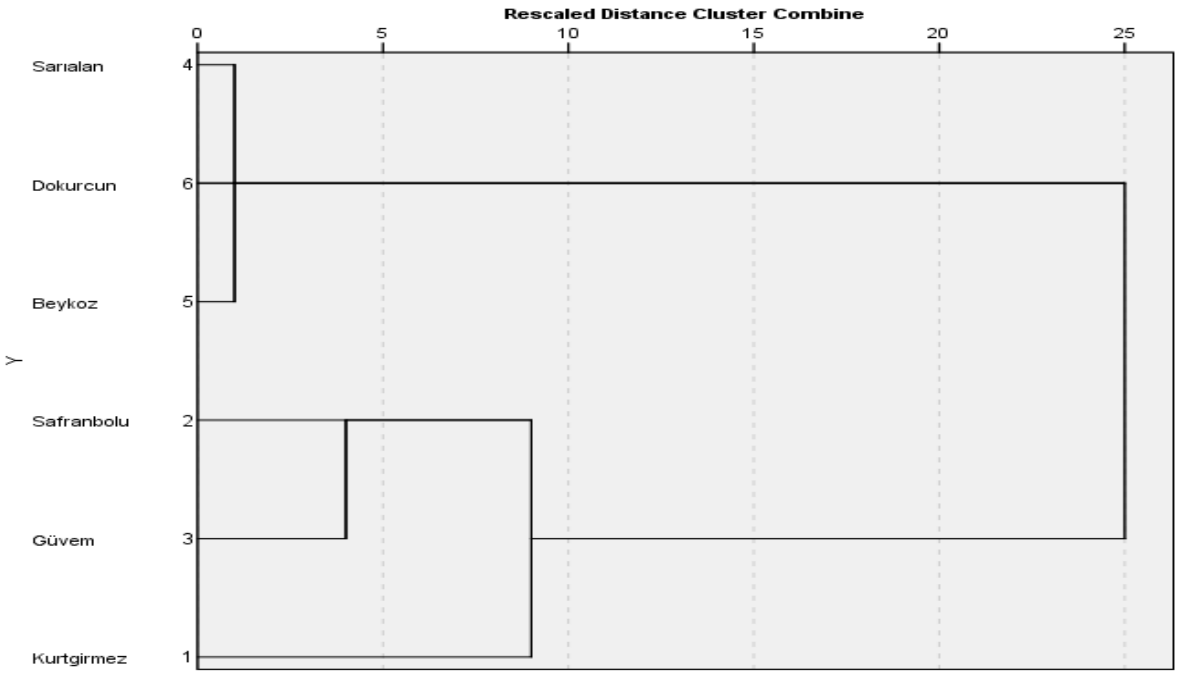

Figure 5. Similarity tree (cluster) between populations using all characters

Conclusion

Populations of Western Black Sea Fir, which is an endemic species, showed highly significant differences in the studied seed characteristics except for seed length. While the populations in the sunny aspects reached lower values in seed size, 1000 seed weights were higher. Although the isolated population reached the highest 1000 seed weight, it was included in the lower populations in terms of seed size (seed width and seed thickness). There was no significant trend in seed characteristics regarding altitude, latitude, and longitude, and the correlations between altitude and seed characteristics were also low.

The studied populations were divided into two main groups in terms of genetic distance. Naming "East" and "West" groups is possible considering the distribution areas of these groups. The genetic distances of the populations in the west group were closer (similar) compared to the east group. In this context, the Istanbul-Beykoz population, which has an isolated population, was also cut off from the West group and showed that artificial migration was possible.

Considering that the research was based on a one-year observation, the study on six Western Black Sea Fir populations showed evidence that no seed transfer should be made between the west and east group or vice versa. In this context, the closest seed resources should be used in regeneration and forestation studies. Moreover, supporting seed characteristic findings with the common garden tests can be better in long-term.

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Submitted: 13.04.2023 Accepted: 13.07.2023

Eurasian Journal of Forest Science

2023 11(2): 36-53

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

Istanbul residents' perceptions of Syrian immigrants' use of the green spaces

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Abstract
The aim of this study is to determine the perceptions of the people of Istanbul regarding Syrian immigrants and their common use of urban green spaces. The causes of conflicts that Istanbul residents and Syrians immigrants have experienced in green spaces are also addressed. An exploratory sequential design was used, being one of the mixed methods in which qualitative and quantitative approaches are used together. Semi-structured interviews and content analysis were conducted for the qualitative part of the study. For the quantitative part, data were collected from 389 people in Istanbul with a survey consisting of Likert-type scale questions. Explanatory factor analysis was performed on the obtained data-set. As a result, it was found that Istanbul's citizens have problems with Syrian immigrants in urban green spaces due to differences in activities, they expect Syrians to speak Turkish in mutual communication, and they do not want to interact with this group due to their negative attitude towards Syrian immigrants. More detailed research should be conducted to reduce the conflict between these groups. In addition, this study reveals that conflicts have increased due to the lack of green spaces, and an increase in green spaces may be proposed as a solution.
Keywords: immigrants, urban green spaces, conflict, perception

Introduction

Migration is the displacement of a person or group of people across an international border or within a state for economic, political, or social reasons, regardless of duration, structure, and reason (IOM, 2009; Tekeli and Erder, 1978). The total population of immigrants who have left their home countries to live in another country was previously determined as 280 million and this number increases every year (UN, 2022).

One of the cornerstones of the present study is Syrian migration, which has dramatically affected Turkey in the past few years. According to data from the UNHCR (2019), the total number of Syrians in Turkey has exceeded 3,600,000 people.

One of the most important issues in studying Syrians in Turkey is that 92% of Syrian immigrants live in cities (Erdoğan, 2017) and the cultural, social, and linguistic differences between them and the local people create problems in the sharing of common areas. However, from another point of view, interacting with

diverse people helps individuals become a part of society and creates a sense of acceptance (Putnam, 2000). The fact that the common areas in city offer people with different social and ethnic origins the opportunity to interact with each other shows how important these areas are in terms of creating social cohesion (Marshall and Stole, 2004; Beckley, 1994). Urban green spaces, which are among these common areas, have an important place in such studies in order to help resolve potential conflicts, reservations, ignorance, and discrimination (Peters et al., 2010; Jay and Schraml, 2009; Nesdale and Todd, 2000).

When sufficient green spaces are offered to people in cities, social cohesion increases between groups due to the feeling of comfort that people enjoy while using these areas and the increase in people's familiarity with each other as a result of their frequent use of such areas. However, due to the lack of sufficient green space and cultural differences between groups, friction may also arise in urban green spaces between groups (Gentin, 2011).

Especially for individuals aged 10-17, outdoor activities are an important way to make new friends. Offering the possibility of increased social cohesion on behalf of future generations, the coexistence of diverse individuals belonging to this age group in urban green spaces including immigrants should be encouraged to provide positive returns (Seeland et al., 2009; Peters et al., 2010).

Interactions in parks are often of a cursory nature and it is seen that people do not want to be in intense communication with people they do not know. However, the idea has emerged that people still feel good because they share the areas that they have adopted with other groups and that even cursory communication comforts or satisfies them. Familiarity with the area created by situations resulting from attachment to green spaces allows people to act more flexibly in establishing relationships (Peters et al., 2010).

The concepts of social inclusion and exclusion lie at the root of the problems created between local people and migrating people in the social, economic, and spatial senses with the intense wave of migration from Syria to Turkey. Among the places where the concepts of social exclusion and inclusion are experienced most intensely are urban green spaces (Bal Kızılhan, 2019).

In order to understand the variables in intercultural green space preferences, it is necessary to understand the concept of images of nature. Images of nature are conceptual reflections of discourses about nature and previous experiences. It is known that the nature of the region in which a culture is formed has an effect on the formation and continual changes of that culture. Accordingly, it is obvious that there is an inseparable relationship between culture and nature and that people from different cultures have different interactions with nature or different expectations of it (Buijs et al., 2009; Van den Born et al., 2001).

In order to show the role of cultural differences in the formation of nature images, it should be noted that many different phenomena play roles in nature shapes when details are examined apart from religion, living conditions, education, and rural-urban divides (Makhzoumi, 2002; Buijs et al., 2009; Van Koppen, 2000).

With the world's increasing urban population, the ecological and social importance of urban green spaces is also steadily increasing (Öner et al., 2007; Konijnendijk, 2005; Dirik, 2001). In the present study, it is important that the Sultangazi Mimar Sinan Urban Forest and Kemerburgaz Urban Forests located in the study area have the characteristics of urban green spaces and that social interactions between Syrians and local people take place in these areas.

The use of urban green spaces together with the host community may cause some disagreements and incompatibilities. On the other hand, these disagreements and incompatibilities in urban green spaces offer clues about what problems exist and form a basis for concrete studies and solutions that can be pursued to

create social cohesion. In this context, it was deemed valuable to carry out this study in Istanbul, which is among the provinces with the highest numbers of Syrian refugees in Turkey, in order to support solutions to the problem of integration. In this context, the aims of the study were identified as follows:

1. To determine what kinds of perceptions (positive or negative) the people of Istanbul have when they engage in recreational activities with Syrian immigrants in the green spaces of the city, and

2. To determine the views and thoughts of the people of Istanbul in order to reduce the social conflict that arises as a result of the use of urban green spaces by Syrian immigrants.

Material and Methods

Study area

Since Istanbul is widely considered to be the place with the highest living conditions in Turkey, for people moving both within the country and from abroad as refugees due to its social and economic opportunities (Aksu et al., 2022), the city has received intense immigration. According to data published by the Refugees Association (2020) on its website, this number of Syrian immigrants in Istanbul was stated as 492,013.

The study area encompasses participants living in the Eyüpsultan, Fatih, and Arnavutköy districts of Istanbul who use local green spaces. These three districts were selected due to differences in their economic welfare levels and the high number of Syrian immigrants that they have received. According to Yılmaz et al. (2019), districts in Turkey may be divided according to different socio-economic development rankings. In this context, the districts in Istanbul are among the first three socio-economic rankings, and the districts of Fatih, Eyüpsultan and Arnavutköy were selected considering those rankings. Fatih is among the top-ranking districts in terms of development level, while Eyüpsultan is among the second-ranked and Arnavutköy is among the third-ranked districts. Another basis for the selection of these districts was the high ratio of their immigrant populations to the general population of the districts. Survey questions were asked to Turkish citizens living in Fatih, Arnavutköy, and Eyüp regions.

Sample Size and Data Collection

The participants of this study were selected by maximum variation sampling, one of the purposive sampling methods for qualitative research.

In this study, in order to obtain qualitative data, questions were asked to people off different ages, genders and economic conditions in Fatih, Arnavutköy, and Eyüpsultan, and according to the results, inferences were made about what to focus on in the quantitative part of the work. In addition, in administering the survey, the necessity of participants being 18 years or older was taken into consideration.

The sample size of the study was determined by considering the general populations of the Fatih, Eyüpsultan and Arnavutköy districts. Since the total population in the study area was 1,090,997 (Erdoğan, 2017), the standard error formula was used with the central limit theorem in determine the sample size:

$n = \pi \times (1 - \pi) / (e / Z)^2$ (Equation 1)

Here, n is sample size, π is variance value, e is margin of error, and Z is the confidence limit (Kurtuluş, 2004).

Considering the sample size according to Equation 1, the number of individuals to be selected from among a population of approximately one was $n = (0.5 \times 0.5) / (0.05/ 1.96)^2 = 384$. Thus, in total, the survey was conducted with 389 people to provide a sufficient sample size.

In the qualitative phase of the study, the data were collected using by one-on-one interview technique. Semi-structured interviews were used in order to ask additional questions, re-ask questions about subjects that were not fully explained, provide flexibility to the participants and gain in-depth answers (Altunışık et al., 2010).

The interview questions, prepared in line with the purpose of the study were developed by taking into account previous studies related to the perceptions and attitudes of citizens of Turkey toward Syrians. Furthermore, the perceptions of local people in Europe and the United States regarding the use of green spaces in cities by immigrants were also taken into consideration by examining the findings of previously conducted studies. Interviews were conducted with 20 people between March 5-12, 2020 in Eyüp, Fatih and Arnavutköy.

After the one-on-one interviews, the qualitative data collection part of the study was completed and the analysis of the obtained data was initiated. Each participant was identified by a code such as F(1), C(2), C(3), C(4), C(5), C(6), C(7), C(8), F(9), F (10), K(11), K(12), ……..., K(19), K(20), and so on. The answers received during the interviews were transcribed without any changes.

The content analysis method was used to analyze the interview records, which were read one by one by the researcher.

In the analysis process, first, the codes were read twice and any meaningful concepts underlined. A total of 280 meaningful concepts were revealed, some consisting of only a word, some a sentence, and some a few sentences. The obtained data were first coded to divide them into meaningful parts. The parts that formed a meaningful whole in themselves were identified by the researcher. Data from different categories that were related in terms of meaning were brought together. As a result, 68 codes emerged.

An item pool was created by converting the meaningful concepts obtained from content analysis of the obtained qualitative data and the codes formed by their combination into scale expressions. This item pool, obtained with the help of expert opinions, was combined using similar questions. Questions that were thought to be inappropriate for the purpose of the study were removed and 46 statements emerged.

The scale used in the study consisted of five demographic questions and 46 five-point Likert-type statements. For the Likert-type statements, participants were asked to score them from 1 (''I strongly disagree'') to 5 (''I strongly agree'').

While this study was being carried out, some limitations were encountered and resolved by applying other methods. One of the limitation is that the survey could not be conducted face-to-face in urban green space due to the COVID-19 pandemic, which has had an impact around the world. The method used to solve that problem was to create a survey form on Google Forms and administer that survey to participants via certain social media and other internet platforms and the data were collected in that way. The survey was carried out between March 14 and May 01, 2020. The fact that the survey was delivered to participants online meant that a younger and more educated audience took part in the survey study. Another limitation encountered is that, before this work, there were not sufficient resources in Turkey regarding urban green space and immigration. The fact that such a study was being conducted for the first time in Turkey led to some methodological difficulties.

Data Analysis

The 5-point Likert-type scoring method was used for the survey. The reliability of the data obtained from the surveys was tested using Cronbach's - alpha. In addition, explanatory factor analysis (EFA) was applied to obtain significant variables. Şafak (2012) was utilized in the method section of the study.

A reliability test was applied using SPSS for Windows for reliability analysis of the perceptions of the people of Istanbul regarding the use of green spaces by Syrian immigrants. For the reliability test, alpha (α) was used and if the variable was deleted, the alpha coefficient of the reliability methods was used.

Cronbach's alpha coefficient or the general reliability coefficient for the perceptions of the people of Istanbul regarding the use of green spaces by Syrian immigrants, based on 46 variables, was 0.702. This value is accepted as reliable in terms of scientific studies conducted in this way. Furthermore, seven items were excluded from the structure as their factor weights did not exceed 0.4.

In this study, principal component analysis and factor analysis were performed to achieve the determined objectives. In addition, since it was thought that there was a relationship between the factors, it was decided to use the direct oblimin technique, an oblique rotation technique. After the rotation process, the factor weights of the items were examined.

Results

Characteristics of the Participants

The demographic characteristics of the 389 participants of the survey are presented in Table 1 under the headings of gender, age, occupation, education level, and residence. As seen in Table 1, the amount of participation between men and women was kept similar in order to facilitate measurements of perception based on gender. While the rate of female participants was 52.3%, the rate of male participants was 47.7%. When age, as another demographic feature, was examined, it was seen that the majority of the participants were between the ages of 25 and 34 years at a rate of 64%.

When the education level was evaluated in Table 1, it can be seen that the majority of the participants had received education to the level of bachelor degree level at a rate of 57%. Participants with graduate education accounted for 21%of the sample. Finally, when the proportions of participants were examined according to their place of residence, the highest numbers of participants were from Fatih at a rate of 43%.

Participants' perceptions of Syrians'utilization of urban green spaces

The distribution of local people's perceptions of Syrians' use of urban green spaces is given in Table 2. There are statements for which one of the options marked by some participants differs greatly from the other options.

From these expressions, for the statement "I communicate with Syrians in urban green spaces to socialize", 51.5% of the participants chose the option "I strongly disagree (1)''. For the statement ''When I see inappropriate behavior by Syrians in urban green spaces, I exhibit a different attitude from my attitude toward Turkish citizens'', it is seen that the option of ''I strongly disagree (1)'' was marked by 55.9% of the participants. For ''I am disturbed by the Syrians' lack of attention to cleanliness in urban green spaces'', the option of ''I strongly agree (5)'' was marked most often at a rate of 50.8%.

Table 1. Demographic characteristics of the participants.

Factor	Demographic Features	Participants	
		Frequency (n)	Percentage
Gender	Female	204	52.3
	Male	185	47.7
	Total	389	100.0
Age, years	18-24	37	10.0
	25-34	249	64.0
	35-44	65	17.0
	45-54	20	5.0
	55+	18	4.0
	Total	389	100.0
Occupation	Teacher	45	11.5
	Doctor	4	1.0
	Engineer	81	20.8
	Architect	21	5.4
	Lawyer	13	3.3
	Nurse	4	1.0
	Worker	62	15.9
	Cashier	2	0.5
	Unemployed	28	7.3
	Student	17	4.4
	Retired	9	2.4
	Academic	8	2.0
	Journalist	7	1.8
	Housewife	15	3.9
	Other	73	18.8
	Total	389	100.0
Education Level	Primary School	2	1.0
	Middle School	11	3.0
	High School	42	11.0
	Associate Degree	32	8.0
	Bachelor Degree	218	57.0
	Master Degree	84	21.0
	Total	389	100.0
Residence	Fatih	167	43.0
	Arnavutköy	125	32.0
	Eyüp	97	25.0
	Total	389	100.0

As is further seen in Table 2, in response to ‘‘I am disturbed by the harassment, teasing, etc. behaviors of Syrians in urban green space’’, the option of ‘‘I strongly agree (5)’’ was selected by 50% of the participants. In response to “I am disturbed by Syrians begging in urban green space” 50.3% of the participants marked “I strongly agree (5)”.

When Table 2 is further examined, it is seen that the statement ‘‘I am uncomfortable with the use of hookah by Syrians in urban green area’’, the option of ‘‘I strongly agree (5)" was 56.7%. For the statement ‘‘Citizens of Turkey should learn Arabic, even if only a little’’, the option of ‘‘I strongly disagree (1)" was 52.6% of the participants. For ‘‘Municipalities should work towards the social cohesion of Syrian children in urban green space’’, the option of ‘‘I strongly agree (5)’’ was 50.5%.

Table 2. Distribution of local people's perceptions of Syrians's use of urban green spaces.

Statements	Participants											
	Frequency (n)						Percentage					
	1	2	3	4	5	Total	1	2	3	4	5	Total
I think it offer social diversity to benefit from urban green spaces with Syrian immigrants.	98	32	86	55	118	389	25.1	8.2	22.1	14.1	30.5	100
I feel pity when I encounter Syrian immigrants in urban green spaces.	100	61	116	68	44	389	25.6	15.6	30	17.4	11.3	100
I feel happy and peaceful because Syrian immigrants benefit from urban green spaces.	94	47	95	60	93	389	24.1	12.1	24.6	15.4	23.8	100
I feel unhappy and restless because of the benefits of Syrian immigrants in urban green spaces.	155	55	73	36	70	389	40	14.1	18.7	9.2	17.9	100
I cannot communicate with Syrian immigrants in the green spaces of the city due to language problems.	56	29	97	73	134	389	14.4	7.4	24.9	18.7	34.6	100
I do not communicate with Syrians in the green spaces of the city because I have nothing in common with them.	67	32	87	55	148	389	17.2	8.2	22.3	14.1	38.2	100
I do not communicate because I am afraid of Syrians in the green spaces of the city.	168	56	83	28	54	389	43.3	14.4	21.3	7.2	12.8	100
I cannot communicate with Syrians because Syrians do not want to communicate with other people in the green spaces of the city.	156	65	104	29	35	389	40.3	16.7	26.7	7.4	9	100
I do not communicate with anyone because I want to spend time alone in the green spaces of the city.	99	37	101	75	77	389	25.6	9.5	25.9	19.2	19.7	100
I communicate with Syrians to help Syrians in the green spaces of the city.	129	73	108	51	28	389	33.3	18.7	27.7	13.1	7.2	100
I communicate with Syrians in urban green spaces to socialize.	200	74	67	25	23	389	51.5	19	17.2	6.4	5.9	100
I communicate with Syrians to warn them about their wrongdoings in urban green spaces.	129	66	81	46	67	389	33.3	16.9	20.8	11.8	17.2	100
When I see Syrians acting inappropriately in urban green spaces, I do not intervene.	106	72	108	61	41	389	27.4	18.5	27.7	15.6	10.8	100

Table 2 (continued). Distribution of local people's perceptions of Syrians's use of urban green spaces.

When I see Syrians acting innapropriatelya in urban green spaces, I warn them by speaking to them.	63	60	121	73	72	389	16.2	15.4	31.3	18.7	18.5	100
When I see Syrians acting innapropriately in urban green spaces, I consult security officials.	105	56	96	66	66	389	27.2	14.4	24.6	16.9	16.9	100
When I see Syrians acting innapropriately in urban green spaces, I exhibit a different attitude from my attitude toward citizens of Turkey	217	39	52	28	53	389	55.9	10	13.3	7.2	13.6	100
I feel uncomfortable when Syrians speak loudly in urban green spaces.	68	39	71	56	155	389	17.4	10	18.2	14.4	40	100
I am disturbed by Syrians' lack of attention to cleanliness in urban green spaces.	44	30	66	52	197	389	11.3	7.7	16.9	13.3	50.8	100
I am disturbed by the harassment, teasing, etc. behaviours of Syrians in urban green spaces.	55	38	54	48	194	389	14.1	9.7	13.8	12.3	50	100
I am disturbed by Syrians begging in urban green spaces.	46	37	69	42	195	389	11.8	9.5	17.7	10.8	50.3	100
I am disturbed by the fact that Syrians do not comply with the relevant rules in urban green spaces.	37	33	63	66	190	389	9.5	8.5	16.2	16.9	49	100
I am uncomfortable with the fact that Syrians are a part of our lives, including in urban green spaces.	143	48	57	40	101	389	36.9	12.3	14.6	10.3	25.9	100
I am uncomfortable with Syrians spending time in groups in urban green spaces.	105	57	59	46	122	389	26.9	14.6	15.1	11.8	31.5	100
I am uncomfortable Syrians using hookahs in urban green spaces.	53	19	53	44	220	389	13.6	4.9	13.6	11.3	56.7	100
I am uncomfortable with Syrians barbecuing in urban green spaces.	60	39	63	49	178	389	15.4	10	16.2	12.6	45.9	100
I do not think that Syrians are different from citizens of Turkey in terms of their attitudes toward urban green spaces.	81	48	68	63	129	389	20.8	12.3	17.4	16.2	33.3	100
I think that Syrians do not leave urban green spaces clean after using them.	34	39	98	61	157	389	8.7	10	25.1	15.6	40.5	100

Table 2 (continued). Distribution of local people's perceptions of Syrians's use of urban green spaces.

I think Syrians damage sports equipment in urban green spaces.	102	62	110	39	76	389	26.2	15.9	28.5	10	19.5	100
I do not think that Syrians cause more damage to equipment/tools/benches in urban green spaces than citizens of Turkey.	71	47	99	50	122	389	18.2	12.1	25.4	12.8	31.5	100
I do not think that Syrians harm equipment/tools in urban green spaces.	67	60	145	59	58	389	17.2	15.4	37.4	15.1	14.9	100
Citizens of Turkey should show empathy towards Syrians in urban green spaces.	57	28	101	73	130	389	14.6	7.2	25.9	18.7	33.6	100
Citizens of Turkey should learn Arabic, even if only a little.	204	58	67	28	32	389	52.6	14.9	17.2	7.2	8.2	100
Syrians should be taught Turkish.	39	20	72	74	184	389	10	5.1	18.5	19	47.4	100
As citizens of Turkey behave appropriately in urban green spaces, Syrians adapt.	75	30	65	84	135	389	19.2	7.7	16.7	21.5	34.9	100
It is necessary to know that citizens of Turkey have priority rights as hosts in urban green spaces and that Syrians are guests.	130	42	70	41	106	389	33.6	10.8	17.9	10.5	27.2	100
Nothing should be done to establish good relations between the two groups in urban green spaces; it should simply be known that Syrians are equal.	92	46	101	59	91	389	23.6	11.8	26.2	15.1	23.3	100
In urban green spaces, municipalities should place information boards in Arabic for Syrians.	170	41	67	53	58	389	43.8	10.5	17.2	13.6	14.9	100
Municipalities should increase security measures toward Syrians in urban green spaces.	69	62	105	55	98	389	17.7	15.9	27.2	14.1	25.1	100
Job opportunities should be offered to people who speak Arabic in urban green spaces.	99	42	97	74	77	389	25.6	10.8	24.9	19	19.7	100
Municipalities should work towards the social cohesion of Syrian children in urban green spaces.	36	15	66	76	196	389	9.2	3.8	16.9	19.5	50.5	100

Table 2 (continued). Distribution of local people's perceptions of Syrians's use of urban green spaces.

Activities such as festivals and bazaars should be organized within the framework of the participation of Syrians in social cohesion in urban green spaces.	87	29	97	69	107	389	22.3	7.4	24.9	17.7	27.7	100
In order for Syrians to contribute to social cohesion, work on daily life should be done before urban green spaces.	34	13	101	69	172	389	8.7	3.3	25.9	17.7	44.4	100
The reason why Turkish citizens and Syrians have problems in urban green spaces is cultural difference.	44	36	88	85	136	389	11.3	9.2	22.6	21.8	35.1	100
The reason why citizens of Turkey and Syrians have problems in urban green spaces is the lack of green spaces.	158	65	81	35	50	389	40.8	16.7	20.8	9	12.8	100
The reason why citizens of Turkey and Syrians have problems in urban green spaces is the language difference.	98	71	107	63	50	389	25.1	18.2	27.7	16.2	12.8	100
The reason why citizens of Turkey and Syrians experience problems in urban green spaces is the media (social, visual and written media).	82	51	111	73	72	389	21	13.1	28.7	18.7	18.5	100

Factor Analysis Findings

The Kaiser-Meyer-Olkin (KMO) coefficient and Barlett sphericity test results were examined to determine the suitability of the data structure of the scale developed in this study. The KMO coefficient of these expressions regarding the perceptions of the people of Istanbul regarding the use of green spaces by Syrian immigrants was found to be 0.913. This value is considered high for factor analysis suitability. Based on the factors included in the EFA results, the definitions of the codes given to the expressions are presented in detail in Table 3. Explanations of the abbreviations given to the factors are also presented in detail in Table 3.

As a result of EFA, the factor weight value of each item was found. It was decided to exclude items with factor weight values below 0.40 from the scale. When items were included in the scale factor analysis together with items whose factor loadings did not exceed 0.40, it was seen that the KMO coefficient of the expressions was 0.932. The factor loadings obtained as a result of EFA are presented in detail in Table 4.

After conducting EFA, it was seen that the items in the scale could be gathered according to interrelated factors. The 46 Likert-type items included in the survey were decreased to a total of 39 as a result of EFA and were gathered within 10 dimensions.

Table 3. Expressions Used in Factor Analysis.

Factors	Statements	Definitions
Factor 1: NTAGSE Negative thoughts about the green space experience	NTAGSE1	I am disturbed by the fact that Syrians do not pay attention to cleanliness in urban green spaces.
	NTAGSE2	I am disturbed by the fact that Syrians do not comply with the relevant rules in urban green spaces.
	NTAGSE3	I am disturbed by the harassment, teasing, etc. of Syrians in urban green spaces.
	NTAGSE4	I am uncomfortable with the use of hookahs by Syrians in urban green spaces.
	NTAGSE5	I think that Syrians do not leave the urban green species clean after using them.
	NTAGSE6	I am uncomfortable with Syrians begging in urban green spaces.
	NTAGSE7	I am uncomfortable with Syrians barbecuing in urban green spaces.
	NTAGSE8	I feel uncomfortable when Syrians speak loudly in urban green spaces.
	NTAGSE9	I am uncomfortable with Syrians spending time in groups in urban green spaces.
	NTAGSE10	I think that Syrians harm sports equipment in urban green spaces.
Factor 2 : PTAGSE Positive thoughts about the green space experience	PTAGSE1	In order for Syrians to contribute to social cohesion, work on daily life should be done before urban green spaces.
	PTAGSE2	Activities such as festivals and bazaars should be organized within the framework of the participation of Syrians in social cohesion in urban green spaces.
	PTAGSE3	In urban green spaces, municipalities should work towards the social cohesion of Syrian children.
	PTAGSE4	Citizens of Turkey should show empathy towards Syrians in urban green spaces.
	PTAGSE5	When I see Syrians acting inappropriately in urban green spaces, I exhibit a different attitude from my attitude toward Turkish citizens.
	PTAGSE6	I feel pity when I encounter Syrian immigrants in urban green spaces.
	PTAGSE7	As citizens of Turkey behave appropriately in urban green spaces, Syrians adapt.
Factor 3 : BFPGSE Behavior in the face of problems in the green space experience	BFPGSE1	When I see Syrians acting inappropriately in urban green spaces, I warn them by speaking to them.
	BFPGSE2	When I see Syrians acting inappropriately in urban green spaces, I do not intervene.

Table 3 (continued). Expressions Used in Factor Analysis.

	BFPGSE3	I communicate to warn Syrians about their wrongdoings in urban green spaces.
Factor 4 : CSASI Communication style or approach of Syrian immigrants	CSASI1	I cannot communicate because Syrians do not want to communicate with other people in the green spaces of the city.
	CSASI2	I do not communicate because I am afraid of Syrians in the green spaces of the city.
Factor 5 : FR Fundamental rights	FR1	Syrians should be taught Turkish.
	FR2	Municipalities should increase security measures towards Syrians in urban green spaces.
	FR3	It is necessary to know that citizens of Turkey have priority rights as hosts in urban green spaces and that Syrians are guests.
	FR4	Nothing should be done to establish good relations between the two groups in urban green spaces: it should simply be known that Syrians are equal.
Factor 6 : SCGE Sources of conflict in the greenfield experience	SCGE1	The reason why citizens of Turkey and Syrians have problems in urban green spaces is the language difference.
	SCGE2	The reason why citizens of Turkey and Syrians have problems in urban green spaces is the lack of green spaces.
	SCGE3	The reason why citizens of Turkey and Syrians experience problems in urban green spaces is the media (social, visual and written media).
	SCGE4	The reason why Turkish citizens and Syrians have problems in urban green spaces is cultural difference.
Factor 7 : CSPI Communication style of the people of Istanbul	CSPI1	I cannot communicate with Syrian immigrants in the green spaces of the city due to language problems.
	CSPI2	I do not communicate with Syrians in the green spaces of the city because I have nothing in common with them.
	CSPI3	I communicate with Syrians in urban green spaces to socialize.
Factor 8: EGSE Empathizing in the green space experience	EGSE1	I do not think that Syrians cause more damage to equipment/tools/benches in urban green spaces than citizens of Turkey.
	EGSE2	I do not think that Syrians harm equipment/tools in urban green spaces.
Factor 9 : CE Cultural Elements	CE1	Citizens of Turkey should learn Arabic even if only a little.
	CE2	In urban green spaces, municipalities should place information boards in Arabic for Syrians.
	CE3	Job opportunities should be offered to people who speak Arabic in urban green spaces.
Factor 10 : DSAFOG Desire to stay away from other groups	DSAFOG1	I do not communicate with anyone because I want to spend time alone in the green spaces of the city.

This 10-factor structure explained 64.371% of the total variance. Considering the factor weights in Table 4, it is seen that these values vary between 0.422 and 0.905. Considering that factor weights between 0.30 and 0.60 are at moderate levels, and between 0.60 and 1 are at high levels, it was noted that 14 of the 39 items in the scale are acceptable and the remaining 25 items are highly acceptable.

Table 4. EFA Results of Variables regarding Istanbul People's Perceptions of Syrian Migrants' Utilization of Green Spaces.

Factors	Eigenvalue	Explained Variance	Factor weights	Communalities	Alpha coefficient when variable is deleted
Factor 1: Negative thoughts about the green field experience	11.167	28.634			
NTAGSE1			0.851	0.815	0.682
NTAGSE2			0.848	0.790	0.687
NTAGSE3			0.826	0.626	0.687
NTAGSE4			0.739	0.623	0.689
NTAGSE5			0.707	0.687	0.688
NTAGSE6			0.671	0.581	0.691
NTAGSE7			0.668	0.610	0.692
NTAGSE8			0.648	0.658	0.690
NTAGSE9			0.508	0.805	0.691
NTAGSE10			0.496	0.602	0.692
Factor 2 : Positive thoughts about the green space experience	3.147	8.068			
PTAGSE1			0.802	0.622	0.697
PTAGSE2			0.767	0.683	0.706
PTAGSE3			0.515	0.697	0.699
PTAGSE4			0.508	0.682	0.708
PTAGSE5			0.480	0.505	0.697
PTAGSE6			0.452	0.490	0.697
PTAGSE7			0.437	0.587	0.706
Factor 3 : Behavior in the face of problems in the green space experience	1.872	4.799			
BFPGSE1			0.865	0.750	0.699
BFPGSE2			0.767	0.662	0.705
BFPGSE3			0.662	0.666	0.690
Factor 4 : Communication style or approach of Syrian immigrants	1.724	4.420			
CSASI1			0.711	0.609	0.687
CSASI2			0.651	0.604	0.689
Factor 5 : Fundamental Rights	1.385	3.551			
FR1			0.831	0.696	0.694

Table 4 (continued). EFA Results of Variables regarding Istanbul People's Perceptions of Syrian Migrants' Utilization of Green Spaces.

FR2			0.588	0.631	0.687
FR3			0.452	0.521	0.695
FR4			0.432	0.562	0.708
Factor 6 : Sources of conflict in the greenfield experience	1.344	3.447			
SCGE1			0.829	0.715	0.694
SCGE2			0.447	0.558	0.699
SCGE3			0.427	0.521	0.705
SCGE4			0.422	0.514	0.689
Factor 7 : Communication style of the people of Istanbul	1.202	3.081			
CSPI1			0.741	0.615	0.693
CSPI2			0.591	0.631	0.695
CSPI3			0.437	0.625	0.704
Factor 8 : Empathizing in the green space experience	1.171	3.004			
EGSE1			0.873	0.717	0.704
EGSE2			0.654	0.580	0.706
Factor 9 : Cultural Elements	1.083	2.776			
KU1			0.808	0.696	0.705
KU2			0.756	0.694	0.707
KU3			0.638	0.652	0.705
10 : Desire to stay away from other groups	1.010	2.591			
DSAFOG1			0.905	0.824	0.700

Discussion and Conclusion

Looking at the age distributions in this study, it is seen that the participation rate of individuals between the ages of 25 and 34 years was 64%, and it is also known that most surveys are conducted with individuals from this age group. Gentin et al. (2019) and Seeland et al. (2009) explained that younger individuals interact more with immigrants in green spaces. Based on that information, it is possible to say that the younger population in this study also interacts more with immigrants or is more active than older individuals.

It was seen that some options were marked at higher rates for some of the items in the survey excludingthe questions about demographic characteristics. Among these, "I communicate with Syrians in urban green spaces to socialize" received the answers of "1" or "2" at a rate of 70.5% (Table 2). This shows us that urban green spaces are places where local people did not want to interact with other groups. Kabaklı Çimen and Ersoy Quadir (2018) also showed in their study that local people do not want to interact with Syrian immigrants in social areas in the city because they had negative thoughts about Syrian immigrants. It can be said that this situation translates similarly into urban green spaces.

Important results were also obtained for ‘‘I am uncomfortable with the use of hookahs by Syrians in urban green spaces". For this statement, the options of ‘‘5’’ and ‘‘4’’ were marked by a total of 68% of participants. A similar situation regarding the use of hookahs and other substances in green spaces was discussed by Gentin (2011). This situation was seen to create problems between immigrants and local people. Peters et al. (2010) also revealed conflicts between ethnic groups due to differences in green space activities, and it is seen that such situations creates conflict in Istanbul in the same way.

‘‘Citizens of Turkey should learn Arabic, even if only a little’’ was scored as ‘‘1’’ or ‘‘2’’ at a combined rate of 67.5%, While ‘‘Syrians should be taught Turkish’’ was scored as ‘‘5’’ and ‘‘4’’ at a combined rate of 66.4%. The distributions of answers for these two items reveal that the local people expect Syrian immigrants to speak Turkish in urban green spaces in the event of any mutual communication.

Dai (2011) stated that green spaces are generally located in areas where privileged people live and that such groups do not welcome people who come to these areas from outside. In the present study, for the statement ‘‘It is necessary to know that citizens of Turkey have priority rights as hosts in urban green spaces and that Syrians are guests’’, the options ‘‘5’’ and ‘‘were marked by combined total of 37.7% of the participants. It was concluded that most of the local people think that green spaces are privileged spaces and that they have priority in these areas.

Another item from the survey was “Municipalities should work towards the social cohesion of Syrian children in urban green spaces”. The options of ‘‘5’’ and ‘‘4’’ were marked by 70% of the participants in total. Jay and Schraml (2009) and Kloek et al. (2015) revealed that the children of immigrant families born in Europe adapt to the culture of the host region faster than the older generation. Based on this, it is possible to say that local people in Istanbul think that second-generation Syrians can adapt more easily.

Inspired by studies conducted in Germany, England, the United States, and the Netherlands (Kloek et al., 2015; Buijs et al., 2009; Gentin, 2011; Jay and Schraml, 2009; Woolley and Amin, 1999; Byrne, 2012) the present study is a pioneer for other studies of this type to be carried out in Turkey. With the guidance of the present study, different perceptions among groups in terms of the use of urban green spaces can be determined in future studies and things to be done to reduce the conflicts between groups in the use of urban green spaces can be discussed.

In Turkey, studies are being carried out in many different fields such as education or health for Syrian immigrants. In terms of urban green spaces, however, this is the first such Turkish study to be conducted on the situation of Syrian immigrants.

Previous studies showed that urban green spaces help increase familiarity among the individuals using the areas (Jay and Schraml, 2009). In this context, it would be beneficial to organize events such as bazaars and festivals that will increase the familiarity of between the two groups of immigrants and locals in the secure setting of urban green spaces.

Previous studies also found that local people have more in common with second-generation immigrants in terms of activities in urban green spaces, as the children of immigrants, or members of the second-generation immigrant population, adapt more easily to the host society (Peters et al., 2010). It is also known that children who enjoy the use of green spaces while they are developing will see benefits in the later stages of their lives (Mustapa, et al., 2019). Based on this fact, the creation of activities for the adaptation and development of Syrian children in urban green spaces will benefit the harmony of these two groups in the long run.

Another situation that causes conflict between local people and Syrian immigrants is the differences in the activities in which they engage in urban green spaces. It was seen in the present study that the most striking activities were the use of hookahs and barbecuing. Limiting these activities to certain areas and banning them in all other green spaces may be considered a solution.

Pollution in green spaces seems to be another cause of conflict. In this context, the establishment of strict rules to reduce littering in green spaces and the employment of officials to monitor frequently visited places such as parks and recreational areas are important both in terms of the preservation of nature pollution and social cohesion.

One of the biggest reasons for conflict in urban green spaces is seen to be the scarcity of green space. Istanbul is at the bottom of the list among major cities of the world with its green space of 2.2% (World Cities Culture Forum, 2018). In this context, due to the scarcity of urban green spaces, the demand cannot be met and causes conflict between groups. In order to reduce such conflict, increasing the number of urban green spaces is presented as another possible solution.

Acknowledgements

This article is a part of a Master's of Science thesis titled "Istanbul Residents' Perception of Use of Green areas by the Syrian Immigrants" prepared by Sezin Kete at the Institute of Graduate Studies, Istanbul University-Cerrahpaşa.

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Submitted: 10.02.2023 Accepted: 22.05.2023

Research Paper-Araştırma Makalesi DOI: 10.31195/ejejfs.1275658

Eurasian Journal of Forest Science

2023 11(2): 54-65

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

Determination of useful boron content of the soils of Kırıkhan-Kumlu region of Hatay province and their relationship with some soil properties

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Abstract

In this study, it was aimed to determine the useful boron content of the soils of Kırıkhan-Kumlu region of Hatay province and its relationships with some physical and chemical properties. For this purpose, a total of 60 soil samples were taken from 0-20 and 20-40 cm depths and from 30 different points to represent the study area. The pH, total salt, composition, cation exchange capacity (CEC), lime, organic matter and useful boron contents of the soils were determined. According to the results of the research; pH contents of the soils were 7.95-8.43; total salt contents 0.009-0.115 %; clay contents 18.88-74.16 %; sand contents 7.12-59.84 %; silt contents 15.28-52.72 %; lime contents 0.47-26.59 %; organic matter contents 1.16-6.08 %; CEC contents 22.26-72.83 me/100 g and useful boron contents 0.10-1.25 mg/kg. In terms of useful boron content of Kırıkhan-Kumlu soils of Hatay province, it was determined that 50.00 % of them were very low, 40.00 % were low and 10.00 % were sufficient at 0-20 cm depth and 50.00 % of them were very low, 43.34 % were low and 6.66 % were sufficient at 20-40 cm depth. While a positive significant relationship was determined between useful boron and salt, clay, lime and CEC contents of soils, a negative significant relationship was determined between useful boron and sand content. Positive significant relationships were determined between salt and clay, lime and CEC contents of the soils, while negative significant relationships were determined between salt and pH and sand contents. Positive significant relationships were determined between clay and organic matter and CEC contents of the study area soils, while negative significant relationships were determined between clay and sand and silt contents. Significant negative relationships were determined between sand and organic matter and CEC contents of the soils. At the same time, while negative significant relationships were determined between silt and CEC and lime and organic matter contents of the soils, positive significant relationships were determined between organic matter and CEC. As a result, it was seen that the useful boron content of the soils in the study area was determined at low and very low levels above 92 % in all soils of the study area and it was seen that the useful boron content of the soils was insufficient and therefore boron fertilization should be done.

Key Words: Kırıkhan-Kumlu, Available Boron, Physical and Chemical Properties

Introduction

Soil is a dynamic entity where plants accumulate the nutrients they need to continue their vital cycles, microorganisms can provide their activities, reduce the negativities of harmful toxicities that prevent the continuity of the life of living life and end their transformation by filtering pollutants harmful to the natural environment (Yeter and Yalçın 2020). In addition to having the desired level of plant nutrients, it is very important for production and productivity that the biological, physical and chemical properties of soils are suitable for agriculture. In field and horticultural agriculture, plants remove a significant amount of nutrients from soils through their roots during their developmental periods, and improper soil management such as unbalanced fertilization reduces the productivity of soils over time. In order to ensure the continuity of the decreasing productivity of agricultural areas, it is of great importance to periodically determine the nutrient

needs and adequacy of plants by soil analysis and to measure the nutrient needs and adequacy of plants (Karaduman and Çimrin 2016).

It has been determined that boron (B), which has a very important place in terms of plant nutrition in agriculture, has antogonistic relationships with nitrogen (N), calcium (Ca), magnesium (Mg), iron (Fe) and manganese (Mn) and synergistic relationships with phosphorus (P), potassium (K), zinc (Zn) and copper (Cu) (Gezgin and Hamurcu, 2006). The most important feature that distinguishes boron from other elements is that its sufficient and toxic amounts in soil are very close to each other. In addition, the proper utilization of B element in the soil for plants is affected by factors such as soil pH, organic matter, moisture, temperature and clay mineralogy (Goldberg 1997). One of the most important reasons for the different sensitivity to B content among species as well as among plants is that plants are physiologically affected differently by B (Demiral et al. 2010).

According to the parent material of the soils, the uptake of B in the soil differs in terms of plants according to the way it is found in the soil and its retention by the soil. Although light textured soils, acidic or alkaline soil pH, low organic matter and high lime content are desired, drought and too much rainfall are the reasons that reduce the utilization of B by plants (Gürel et al. 2010).

Many similar studies have been conducted on the boron status of agricultural soils. In a study conducted in the same region, Açıkel and Yalçın (2021) aimed to determine the useful boron content of the soils of Reyhanlı-Kumlu region of Hatay province and its relations with some physical and chemical properties. According to the results of the study; pH contents of the soils were found between 6.86-8.44 %; total salt contents between 0.007-0.070 %; clay contents between 15.84-76.56 %; sand contents between 0.72-51.44 %; silt contents between 16.72-47.28 %; lime contents between 2.71-64.23 %; organic matter contents between 0.40-2.89 %;CEC contents between 26.43-91.13 me/100 g and useful boron contents between 0.07-1.76 mg/kg. In terms of useful boron content of Reyhanlı-Kumlu soils of Hatay province, 22.50 % of them were very low, 50.00 % of them were low and 27.50 % of them were sufficient at 0-20 cm depth and 37.50 % of them were very low, 40.00 % of them were low and 22.50 % of them were sufficient at 20-40 cm depth. As a result, in the study area soils, the useful boron content of the soils was determined as low and very low level over 77 % in all study area soils and it was seen that the useful boron content of the soils was insufficient and therefore boron fertilization should be done. In a study conducted in the same region, Yalçın and Çimrin (2017) aimed to determine the boron content of the meadow-pasture soils in the Kırıkhan-Reyhanlı region of Hatay province and to determine their relationship with some soil properties. According to the results of their study; pH contents of the soils were found between 6.85-8.16; salt content 0.01-0.21 %; clay contents 4.60-65.30 %; sand contents 8.70-85.40 %; silt contents 8.00-58.00 %; lime contents 3.40-53.95 %; organic matter contents 0.29-5.52 % and available boron contents 0.00-1.31 ppm. At the same time, in terms of boron content of meadow pasture soils, 70 % of them were found to be very low, 27.50 % were found to be low and 2.50 % were found to be sufficient at 0-20 cm depth, while 72.50 % were found to be very low, 17.50 % were found to be low and 10 % were found to be sufficient at 20-40 cm depth. In addition, they determined a negative significant relationship between boron and sand contents of soils, while they determined positive significant relationships between boron and salt, clay, silt and lime contents. In another study, Çimrin et al. (2019) aimed to determine the boron status of olive orchard soils in Nizip district of Gaziantep province. According to the results of the study; pH contents of the soils were found between 7.93-8.44; salt contents between 0.010-0.043 %; clay contents between 33.04-61.04 %; sand contents between 11.68-35.36 %; silt contents between 18.32-50.32 %; lime contents between 8.11-93.28 % and available boron contents between 0.06-1.18 ppm. In terms of boron content of the garden soils, it was determined that 85.00 % was very low, 10.00 % was low and 5.00 % was sufficient at 0-30 cm depth, 95.00 % was very low and 5.00 % was low at 30-60 cm depth.

In this study, it was aimed to determine the useful B levels of the soils of Kırıkhan-Kumlu region of Hatay province and their relationships with some soil properties and to shed light on the farmers of the region in the future studies for agricultural purposes.

Materıals and methods

Material

A total of 60 soil samples taken from 30 different points (Figure 1; Table 1) and 2 different depths (0-20 and 20-40 cm) in Kırıkhan-Kumlu region of Hatay province were dried in soil drying pans in the laboratory in order to determine useful B, basic chemical and physical properties of the soils.

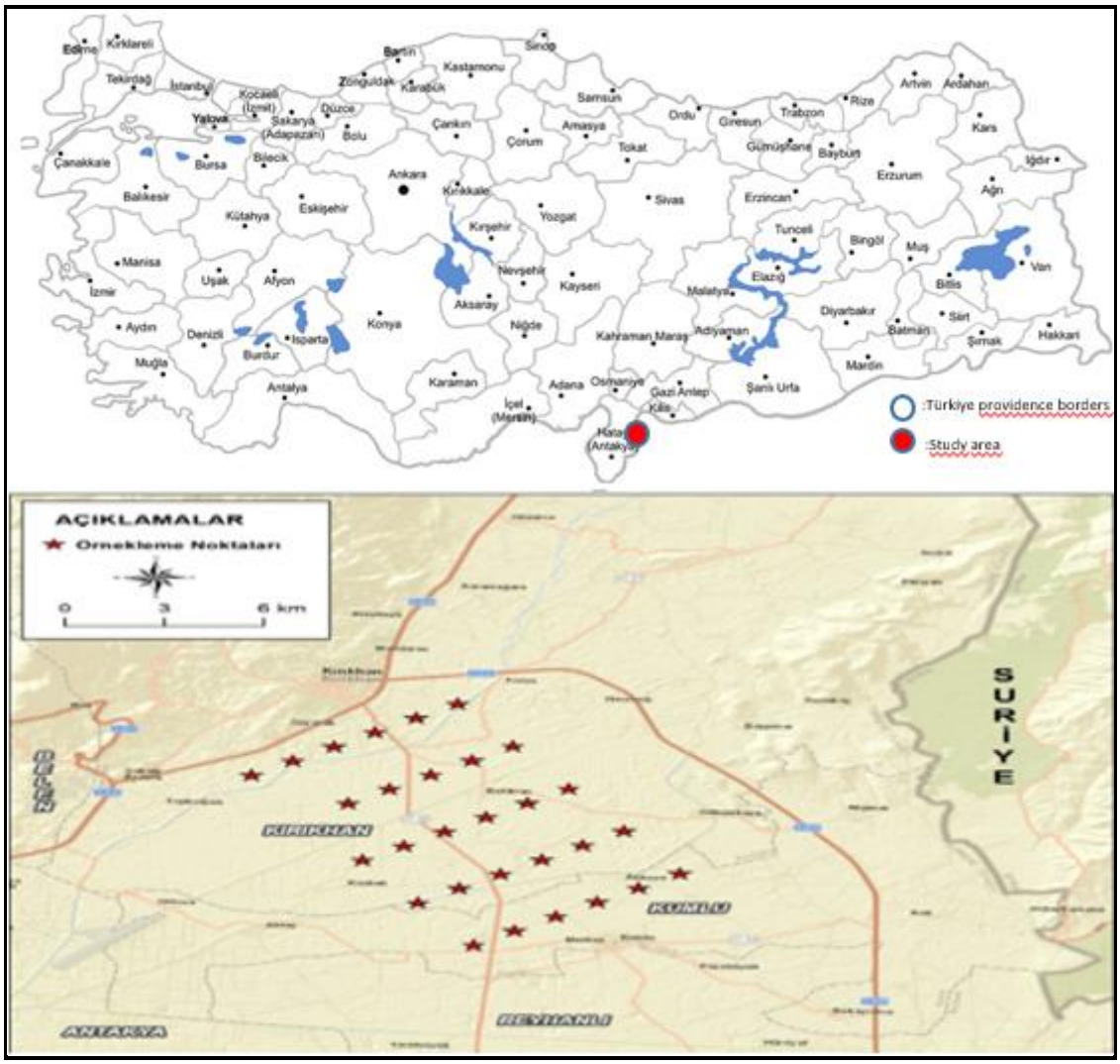

Figure 1. Map of the region where the research soils were taken

Method

Soil samples were analyzed for useful boron, pH, total soluble salt, CEC, DK (Na and K), lime, OM and composition. Useful B analysis of soils was determined by using ICP-OES in the filtrate obtained by using 0.01 M mannitol + 0.01 M $CaCl_2$ extract solution (Cartwright et al. 1983). Total soluble salt was determined from the resistivity values of the saturation sludge measured with a conductivity instrument, and pH was measured with a pH-meter in the saturation sludge (Horneck et al. 1989). CEC was determined by sodium acetate (1N pH: 8.2) extraction method (Knudsen et al. 1982). Lime ($CaCO_3$) content of soils was measured by Scheibler calcimeter (Nelson 1982), OM content of soils was determined by modified Walkley-Black method as reported by Nelson and Sommers (1982). The soil composition of the soils in the study area was determined by hydrometer method (Bouyoucos 1952).

Table 1. Locations where soil samples were taken between Reyhanlı-Kumlu

Soil Number	Sample Place	N/E with GPS Coordinates	Soil Number	Sample Place	N/E with GPS Coordinates
1	Reşatlı	(54.2910 - 40.3829)	16	Özkızılkaya-1	(54.4676 - 40.3183)
2	İçada-1	(54.2162 - 40.3762)	17	Özkızılkaya-2	(54.3927 - 40.3116)
3	İçada-2	(54.1415 - 40.3696)	18	Kumlu-1	(54.3178 - 40.3049)
4	Karadurmuşlu-1	(54.0667 - 40.3629)	19	Kumlu-2	(54.9522 - 40.2931)
5	Karadurmuşlu-2	(53.9920 - 40.3563)	20	Kumlu-3	(54.8536 - 40.2898)
6	Torun	(53.9172 - 40.3496)	21	Akkerpiç-1	(54.7549 - 40.2866)
7	Baldıran-1	(54.5006 - 40.3614)	22	Akkerpiç-2	(54.6562 - 40.2833)
8	Baldıran-2	(54.4258 - 40.3547)	23	Akkuyu	(54.5575 - 40.2800)
9	Muratpaşa-1	(54.3511 - 40.3481)	24	Kumlu-4	(54.4588 - 40.2767)
10	Muratpaşa-2	(54.2763 - 40.3414)	25	Kumlu-5	(54.9716 - 40.2481)
11	Güventaş-1	(54.2016 - 40.3348)	26	Kumlu-6	(54.8717 - 40.2477)
12	Güventaş-2	(54.1268 - 40.3281)	27	Kumlu-7	(54.7718 - 40.2473)
13	Kangallar-1	(54.6923 - 40.3383)	28	Muharrem	(54.6719 - 40.2468)
14	Kangallar-1	(54.6174 - 40.3316)	29	Kırcaoğlu-1	(54.5720 - 40.2464)
15	Kangallar-1	(54.5425 - 40.3250)	30	Kırcaoğlu-2	(54.4721 - 40.2460)

Results and Discussion

Some physical and chemical properties of soils

The findings of some physical and chemical properties of the soil characteristics of the study area are given in Table 2. The lowest pH content of the study soils was 7.95 and the highest pH content was 8.43. The average pH content of the soil samples at 0-20 cm depth was 8.13, while the average pH content of the samples at 20-40 cm depth was 8.13. According to the classification given by Ülgen and Yurtsever (1995), all of the soil samples in the study area were slightly alkaline (Yeter and Yalçın 2020) (Table 2). Yalçın and Çimrin (2021) working on the soils of the same region, aimed to determine the content of some macro and micronutrients in the soils of the Kırıkhan-Reyhanlı region of Hatay province and their relationship with some soil properties and to determine their fertility status and reported similar results by revealing that the pH content of the soils varied between 7.57-8.36 and that they had a slightly alkaline reaction throughout the whole area.

The lowest salt content of the soils of the study area was 0.009 % and the highest salt content was 0.115 %. While the average salt content of the samples at 0-20 cm depth was 0.043 %, it was 0.047 % in the samples at 20-40 cm depth and 0.046 % in the average of both depths. It was determined that the % salt contents of the soil samples were in the salt-free class throughout the entire profile according to the limit values reported by Richards 1954 (Table 2). Açıkel and Yalçın (2021) determined the total salt content of the soils between 0.007 % and 0.070 % and found that all the soils were in the non-saline class in the study which aimed to determine the useful boron content of the soils of Reyhanlı-Kumlu region of Hatay province and its relations with some soil properties. The lowest clay, sand and silt contents of Kırıkhan-Kumlu soils were 18.88 %, 7.12 % and 15.28 %, while the highest clay, sand and silt contents were 74.16 %, 59.84 % and 52.72 %, respectively. The average amounts of clay, sand and silt in the 0-20 cm depth of the soils were 40.52 %, 20.87 % and 30.03 %, while the average amounts of clay, sand and silt in the 20-40 cm depth samples were 48.88 %, 22.34 % and 27.18 % and the average amounts were 43.31 %, 21.61 % and 15.28 %.

Table 2. Boron content and some physical and chemical properties of Kırıkhan-Kumlu soils

Soil Number	Depth	pH	Salt %	Clay %	Sand %	Silt %	Texture Class	Lime %	O.M. %	CEC me/100gr	B mg/kg
1	0-20	8.31	0.031	46.88	17.12	36.00	C	0.94	3.18	41.17	0.30
	20-40	8.24	0.027	48.88	19.84	31.28	C	0.79	3.40	43.39	0.25
2	0-20	8.10	0.027	34.16	31.12	34.72	CL	0.63	3.25	35.74	0.15
	20-40	8.14	0.025	34.88	35.12	30.00	CL	0.47	2.96	37.13	0.45
3	0-20	8.14	0.025	44.88	17.12	38.00	C	1.10	2.81	42.26	0.20
	20-40	8.10	0.032	42.88	19.12	38.00	C	0.47	3.69	43.04	0.10
4	0-20	8.43	0.023	20.88	57.12	22.00	SCL	14.32	1.61	22.26	0.15
	20-40	8.39	0.023	18.88	59.84	21.28	SL	10.86	1.16	22.74	0.20
5	0-20	7.99	0.043	52.88	19.84	27.28	C	4.88	5.48	71.48	0.45
	20-40	8.02	0.059	54.88	17.12	28.00	C	1.73	6.08	72.83	0.30
6	0-20	8.34	0.015	28.88	41.12	30.00	CL	0.94	2.71	29.39	0.10
	20-40	8.28	0.013	28.88	45.12	26.00	SCL	0.94	2.57	30.00	0.10
7	0-20	8.02	0.033	40.88	21.12	38.00	C	21.87	3.02	38.30	0.40
	20-40	8.02	0.032	38.88	15.12	46.00	SiCL	19.04	2.69	40.22	0.30
8	0-20	7.98	0.104	32.16	15.12	52.72	SiCL	13.69	1.81	36.35	1.05
	20-40	7.95	0.109	34.88	35.84	29.28	CL	22.66	2.88	37.26	0.85
9	0-20	8.03	0.033	58.88	15.12	26.00	C	8.97	4.43	69.78	0.25
	20-40	8.02	0.058	60.88	15.12	24.00	C	14.00	4.32	64.65	0.30
10	0-20	8.06	0.050	38.88	35.84	25.28	CL	7.71	1.38	31.83	0.25
	20-40	8.13	0.041	38.88	37.12	24.00	CL	11.64	1.98	30.78	0.35
11	0-20	8.18	0.032	49.28	17.12	33.60	C	24.70	3.73	45.30	0.45
	20-40	8.16	0.051	54.16	19.12	26.72	C	18.10	2.42	45.30	0.50
12	0-20	8.06	0.033	60.16	7.12	32.72	C	16.99	2.64	45.96	0.40
	20-40	8.10	0.033	54.88	19.84	25.28	C	19.35	3.15	53.17	0.70
13	0-20	8.05	0.057	58.88	15.84	25.28	C	14.95	2.80	54.35	0.70
	20-40	8.13	0.044	58.88	11.84	29.28	C	8.34	2.64	60.74	0.70
14	0-20	8.08	0.046	64.88	14.56	20.56	C	12.75	2.84	45.61	0.95
	20-40	8.09	0.059	62.88	16.56	20.56	C	12.27	2.75	53.65	1.00
15	0-20	8.04	0.054	54.16	18.56	27.28	C	21.40	3.51	55.09	0.85
	20-40	8.00	0.059	58.16	17.84	24.00	C	22.03	2.75	53.78	0.85
16	0-20	8.20	0.043	60.16	20.56	19.28	C	15.73	2.64	48.57	0.55
	20-40	8.22	0.081	62.16	20.56	17.28	C	26.59	2.65	50.43	0.55
17	0-20	8.31	0.057	68.88	11.84	19.28	C	11.96	2.59	56.09	0.55
	20-40	8.32	0.052	70.16	14.56	15.28	C	17.15	2.57	59.70	0.50
18	0-20	8.32	0.020	36.88	16.56	46.56	SiCL	20.77	1.87	40.13	0.40
	20-40	8.28	0.021	34.16	22.56	43.28	SiCL	15.42	1.73	40.17	0.35
19	0-20	7.99	0.069	36.88	17.84	45.28	SiCL	22.34	1.94	40.13	0.85
	20-40	8.11	0.044	42.88	8.56	48.56	SiC	12.90	2.02	42.00	0.60
20	0-20	8.07	0.066	42.88	22.56	34.56	C	18.25	1.50	43.22	0.55
	20-40	8.07	0.071	38.88	26.56	34.56	CL	25.18	1.43	41.91	0.45

As can be seen in Table 2, Kırıkhan-Kumlu soils of Hatay province are classified into 6 different texture classes as 65.00 % clay (C), 20.00 % clay loam (CL), 8.34 % silty clay loam (SiCL), 3.34 % sandy clay loam (SCL), 1.66 % sandy loam (SL) and 1.66 % silty clay (SiC) (Table 2). In the study conducted in this region, Açıkel and Yalçın (2021) aimed to determine the useful boron content of the soils of Reyhanlı-Kumlu region of Hatay province and their relationship with some soil properties and they found similar results in terms of clay, sand and silt contents of the soils.

While the lowest lime content of the study soils was 0.47 %, the highest lime content was determined as 26.59 %. While the average lime content of the soil samples at 0-20 cm depth was 13.93 %, it was 13.80 % at 20-40 cm depth and 13.86 % at two depths.

Table 2. (Continued)

Soil Number	Depth	pH	Salt %	Clay %	Sand %	Silt %	Texture Class	Lime %	O.M. %	CEC me/100gr	B mg/kg
21	0-20	8.31	0.028	72.16	9.84	18.00	C	19.98	2.82	61.43	1.15
	20-40	8.24	0.032	74.16	9.84	16.00	C	14.48	2.58	62.13	0.95
22	0-20	8.10	0.062	71.44	12.56	16.00	C	12.75	3.13	60.74	0.65
	20-40	8.14	0.051	71.44	12.56	16.00	C	16.68	2.97	64.96	0.95
23	0-20	8.14	0.043	67.44	10.56	22.00	C	16.36	2.90	64.83	1.00
	20-40	8.10	0.045	65.44	8.56	26.00	C	11.49	2.70	62.61	0.35
24	0-20	8.43	0.031	39.44	28.56	32.00	CL	6.45	2.45	42.00	0.40
	20-40	8.39	0.025	39.44	30.56	30.00	CL	9.28	2.07	43.26	0.30
25	0-20	7.99	0.038	59.44	12.56	28.00	C	15.11	1.79	61.91	0.25
	20-40	8.02	0.043	61.44	12.56	26.00	C	20.61	2.19	61.04	0.70
26	0-20	8.34	0.065	61.44	12.56	26.00	C	22.97	1.91	53.96	0.85
	20-40	8.28	0.074	59.44	10.56	30.00	C	20.46	1.62	54.96	1.20
27	0-20	8.02	0.043	63.44	12.56	24.00	C	17.31	2.17	60.43	1.25
	20-40	8.02	0.038	65.44	16.56	18.00	C	16.68	1.85	62.61	0.25
28	0-20	7.98	0.009	27.44	38.56	34.00	CL	14.79	1.35	28.39	0.15
	20-40	7.95	0.016	27.44	40.56	32.00	CL	14.00	1.44	31.83	0.60
29	0-20	8.03	0.022	39.44	34.56	26.00	CL	18.25	1.87	35.65	0.50
	20-40	8.02	0.047	41.44	34.56	24.00	C	16.99	1.78	39.35	0.95
30	0-20	8.06	0.076	51.44	20.56	28.00	C	19.20	2.26	68.00	0.70
	20-40	8.13	0.115	55.44	16.56	28.00	C	13.53	2.70	66.87	0.30
Min		**7.95**	**0.009**	**18.88**	**7.12**	**15.28**		**0.47**	**1.16**	**22.26**	**0.10**
Max		**8.43**	**0.115**	**74.16**	**59.84**	**52.72**		**26.59**	**6.08**	**72.83**	**1.25**
Ave.	**0-20**	**8.13**	**0.043**	**40.52**	**20.87**	**30.03**		**13.93**	**2.61**	**47.68**	**0.55**
Ave.	**20-40**	**8.13**	**0.047**	**48.88**	**22.34**	**27.18**		**13.80**	**2.59**	**49.08**	**0.53**
	Ave.	**8.13**	**0.046**	**43.31**	**21.61**	**15.28**		**13.86**	**2.60**	**48.50**	**0.54**

According to the classification given by Ülgen and Yurtsever (1995), the lime contents of the soil samples ranged from low calcareous to very high calcareous, but 11.66 % of the soils were found to be low calcareous, 5.00 % calcareous, 35.00 % medium calcareous, 45.00 % high calcareous and 3.33 % very high calcareous (Yeter and Yalçın 2020) (Table 2). Yalçın (2020) determined the pH, lime, organic matter and cation exchange capacity contents of Kırıkhan-Reyhanlı agricultural soils in Hatay province and found similar results in terms of lime contents of the soils.

While the lowest organic matter content of the soils was 1.16 %, the highest organic matter content was determined as 6.08 %. The average organic matter content of the soil samples at 0-20 cm depth was 2.61 %, while it was 2.69 % in the samples at 20-40 cm depth and 2.60 % was found on average at both depths. According to the classification given by Ülgen and Yurtsever (1995), the organic matter of the soil samples ranged from low to high, with 30.00 % of the soils having low organic matter, 48.33 % having medium organic matter, 15.00 % having good organic matter and 6.66 % having high organic matter (Yeter and Yalçın 2020) (Table 2). Gökpınar and Yalçın (2020) determined the pH, lime, organic matter and cation exchange capacity contents of the soils of Arsuz region of Hatay province and reported similar results by revealing the organic matter content of the soils as low and medium values above 87 %.

The lowest CEC content of the soils was 22.26 me/100g and the highest CEC was 72.83 me/100g. While the average CEC of the samples at 0-20 cm depth was 47.68 me/100g, it was 49.08 me/100g in the samples at 20-40 cm depth and 48.50 me/100g was found on average at two depths. It was determined that there were no samples in the low and medium class among the CEC values of the soil samples, 71.25 % of the samples were in the very high class and 28.75 % of the samples were in the high class. Yalçın (2020) determined the pH, lime, organic matter and cation exchange capacity contents of the agricultural soils of Kırıkhan-Reyhanlı in Hatay province and found close values in terms of cation exchange capacity of the soils.

When useful boron (B) in soil was analyzed, the lowest useful B concentration was 0.10 mg/kg and the highest useful B concentration was 1.25 mg/kg in soil samples. While the useful boron content of the soil samples

taken from 0-20 cm depth was 0.55 mg/kg, it was 0.53 mg/kg in the soil samples taken from 20-40 cm depth and 0.54 mg/kg on average. When compared according to Wolf (1971) soil boron limit values, 50.00 % of the Kırıkhan-Kumlu soils at 0-20 cm depth were very low (<0.5 mg/kg), 40.00 % were low (0.5-1. 0 mg/kg), 10.00 % were at adequate level (1.0-2.4 mg/kg), 50.00 % were at very low (<0.5 mg/kg), 43.34 % were at low (0.5-1.0 mg/kg) and 6.66 % were at adequate level (1.0-2.4 mg/kg) at 20-40 cm depth (Table 2). Yalçın and Çimrin (2017) determined the boron content of the meadow-pasture soils of Kırıkhan-Reyhanlı region of Hatay province and their relationship with some soil properties and reported similar results by obtaining very low to low values above 90% in terms of useful boron content of soils. Özkutlu et al. (2016) reported that the soils were inadequate in terms of useful boron content in the study in which they aimed to determine the B (boron) nutrition of some tea gardens in the center of Rize and their relations with soil properties.

Relationships between useful boron content and some other soil properties

The relationships between some physical and chemical properties of the investigated soil properties and their useful boron contents are given in Table 3. As can be seen from the table, a positive significant relationship was determined between useful boron and salt contents (r: 0.41***; Figure 2), clay contents (r: 0.48***; Figure 3), lime contents (r: 0.51***; Figure 4) and CEC contents (r: 0.35***; Figure 5), while a negative significant relationship was determined between useful boron and sand contents (r: -0.43***; Figure 6). In a study conducted in the same region, Yalçın and Çimrin (2017) reported similar results in the study titled "Determination of boron content of meadow-pasture soils of Kırıkhan-Reyhanlı region of Hatay province and determination of their relationship with some soil properties" by determining a positive significant relationship between useful boron content of soils and salt, clay and lime contents, while a negative relationship was found between boron content and sand content. In addition, negative correlations were determined between the pH content of soils and salt content (r: -0.29*). Positive significant relationships were determined between salt content and clay content (r: 0.28*), lime content (r: 0.36***) and CEC content (r: 0.35***), while negative relationships were determined between salt content and sand content (r: -0.30*). Yalçın et al. (2018) reported similar results by determining positive relationships between salt content and clay, lime and CEC contents of the soils, while a significant negative relationship was determined between salt content and sand content in the study which aimed to determine the macro and micronutrient status of meadow-pasture soils in Kırıkhan Reyhanlı region of Hatay province and their relationships with some soil properties and to determine their productivity status. While positive significant relationships were determined between clay content and organic matter content (r: 0.34***) and CEC content (r: 0.85***), negative significant relationships were determined between clay content and sand content (r: -0.80***) and silt content (r: -0.56***). Çimrin et al. (2019) reported similar results by determining negative significant relationships between clay contents of soils and sand and silt contents in their study aiming to determine the boron status of olive orchard soils in Nizip district of Gaziantep province. In addition, in this study, negative significant relationships were determined between sand contents of soils and organic matter contents (r: -0.32*) and CEC contents (r: -0.75***). Yalçın and Çimrin (2019) aimed to determine the boron content of large soil groups of Siverek district of Şanlıurfa province and to determine their relationship with some soil properties. They determined a significant negative relationship between sand content and organic matter content of soils and showed similar results. Negative significant relationships were determined between silt content and CEC content (r: -0.40***) and between lime content and organic matter content (r: -0.35***). At the same time, a positive significant relationship was determined between the organic matter content of the soils and their CEC content (r: 0.52***). Kars and Ekberli (2019) reported similar results by determining a significant positive correlation between organic matter content of soils and CEC content of soils in their study aiming to investigate some physical and chemical soil properties of cultivated agricultural fields in Çarşamba Plain.

Table 3. Correlation coefficients (r) between useful Boron and some soil properties of Kırıkhan-Kumlu soils

	B mg/kg	pH	Salt (%)	Clay (%)	Sand (%)	Silt (%)	Lime (%)	OM (%)
pH	-0.17							
Salt (%)	0.41***	-0.29*						
Clay (%)	0.48***	-0.08	0.28*					
Sand (%)	-0.43***	0.21	-0.30*	-0.80***				
Silt (%)	-0.20	-0.16	-0.05	-0.56***	-0.03			
Lime (%)	0.51***	-0.19	0.36***	0.24	-0.24	-0.08		
OM (%)	-0.11	-0.18	0.02	0.34***	-0.32*	-0.13	-0.35***	
CEC (me/100gr)	0.35***	-0.22	0.35***	0.85***	-0.75***	-0.40***	0.14	0.52***

* 0.05 düzeyinde önemli, *** 0.001 düzeyinde önemli

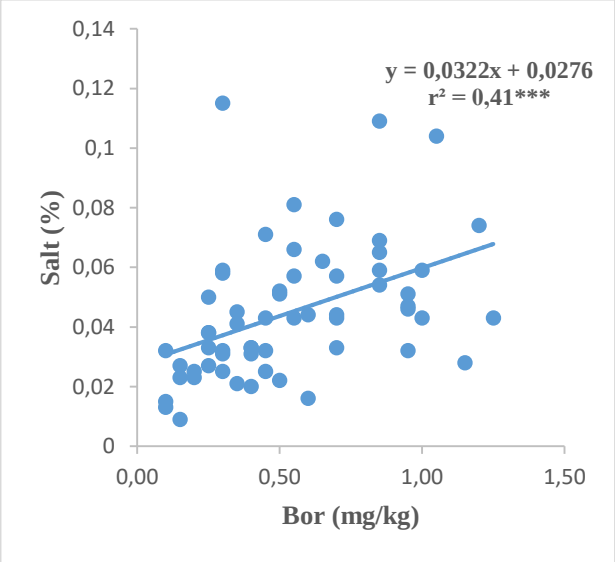

Figure 2. Relationship between useful boron and salt contents of soil samples

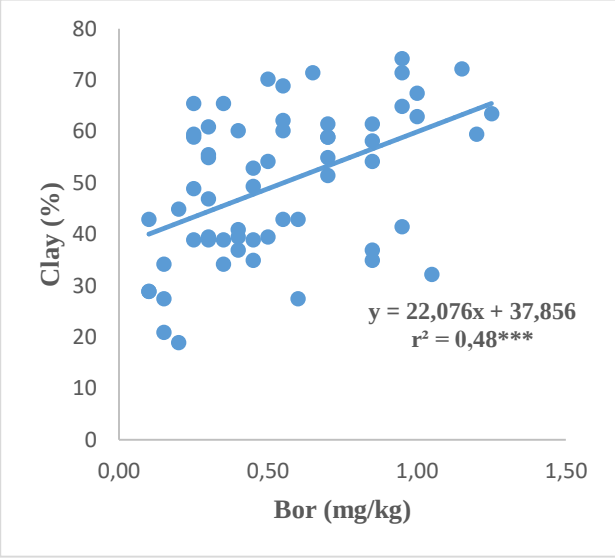

Figure 3. Relationship between useful boron and clay contents of soil samples

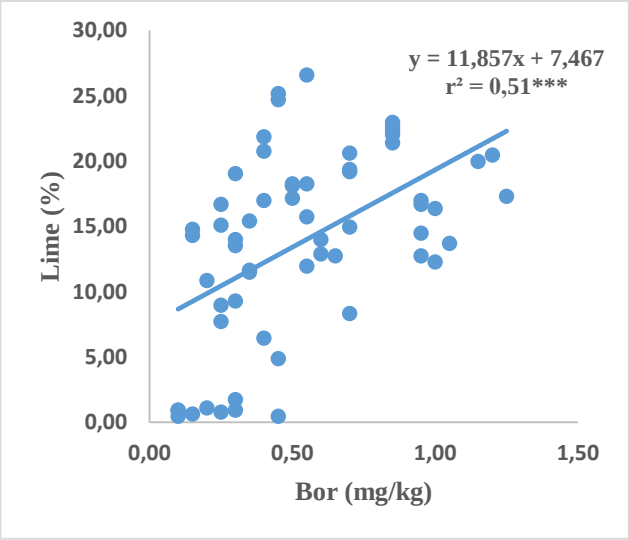

Figure 4. Relationship between useful boron and lime contents of soil samples

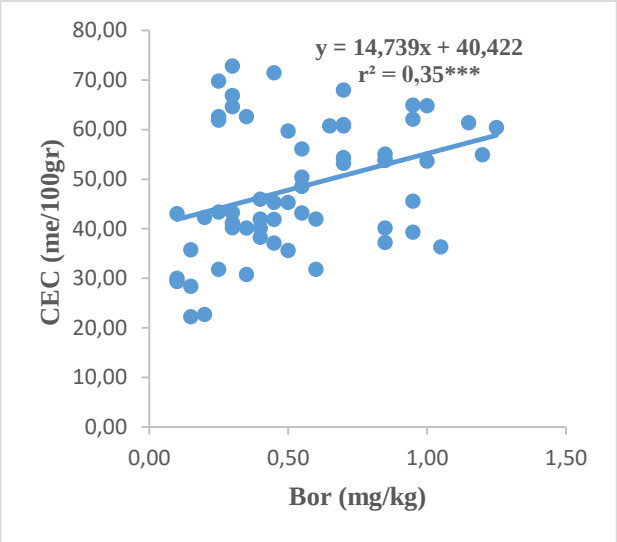

Figure 5. Relationship between useful boron and CEC contents of soil samples

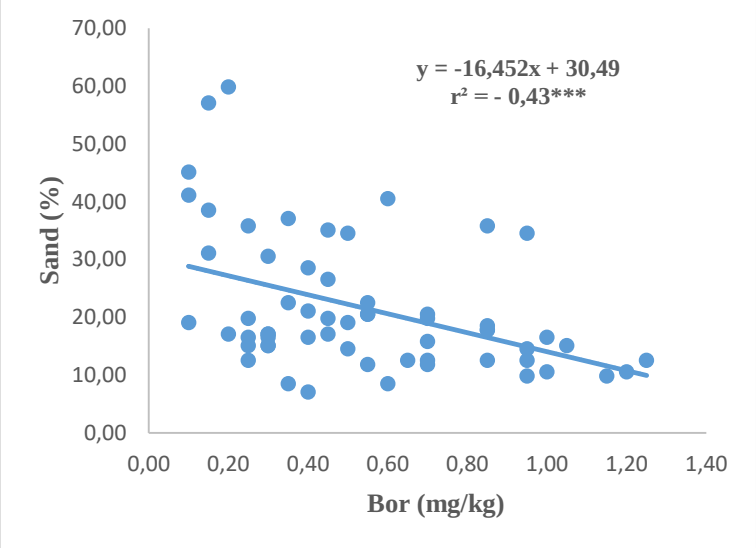

Figure 6. Relationship between useful boron and sand contents of soil samples

Conclusion

The pH values of the soils of Kırıkhan-Kumlu region of Hatay province were between 7.95-8.43 with a slightly alkaline reaction and the total salt content of the soils was determined between 0.009-0.115 % and it was revealed that all the soils of the region were classified as salt-free. The clay, sand and silt contents of the study area were determined as 18.88-74.16 %, 7.12-59.84 % and 15.28-52.72 % respectively, and nearly 85% of the soils were clay and clay loam. The lime content of the soils in the research area varied between 0.47-26.59 %, generally ranging from low to very high lime content and organic matter content ranged between 1.16-6.08 % and it was determined that the organic matter content of the soils was generally at low to medium levels. In addition, the cation exchange capacity (CEC) of the soils varies between 22.26-72.83 me/100 g and the useful B content of the soils in the study area is between 0.10-1.25 mg/kg and more than 92% of the soils contain very little to little useful B and it is determined that there is B deficiency in the study area.

When the results of the analysis of the soils of the study area are considered, it is seen that the most important problems of the soils of the study area are low organic matter, fine texture, poor drainage, high lime content and insufficient level of useful B content. It was observed that there was no salinity problem in the soils

sampled. One of the most important problems of Kırıkhan-Kumlu soils of Hatay province is the insufficient level of useful B content in the soils. Inadequate level of B content in soils means that crop production is negatively affected and the yield to be obtained is much less.

In this respect, the most important solution is to fertilize the soils with enough B-containing fertilizers to increase crop production. During the fertilization of soils, studies can be carried out to reduce the insufficient B content in soils by raising awareness of farmers to fertilize their soils with B-containing fertilizers.

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Submitted: 02.04.2023 Accepted: 18.05.2023

Eurasian Journal of Forest Science

2023 11(2): 66-78

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

A Preliminary mitochondrial cytochrome *c* oxidase-I-based phylogeographic and phylogenetic analysis of Eurasian *Acanthocinus griseus* (Coleoptera, Cerambycidae)

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Abstract

Acanthocinus griseus (Fabricius, 1792) (Coleoptera: Cerambycidae, Lamiinae, Acanthocinini) has long been known for its role in the decay process of the wood in the forest ecosystem, and two critical features of the species, inhabiting standing trees and being a vector of pine wood nematodes *Bursaphelenchus* spp., have been noted recently. Therefore, understanding the current relationships and possible migration scenarios has been further required to assess invasion risks. The present work provided a preliminary comprehension of the phylogeographic and phylogenetic relationships of *A. griseus* based on the mitochondrial cytochrome *c* oxidase-I (COI) gene region (658 bp), with sequences produced in the present study, from the specimens collected from timberyards, ports and forests of Kocaeli Province, Turkey, and with available sequences in GenBank of inhabitants of Eurasia, and of intercepted specimens in ports. The intraspecific genetic distance of *A. griseus* was 1.37-0,3%, while the interspecific distance was 10,79-13,37%, except the closeness of an *A. griseus* haplotype (AGR1) to *A. sachalinensis* (0,3%) more than its conspecifics (4,71-5,47%). The ML and BI analyses suggested identical topologies. The statistical parsimony network drew a reticular branching diagram without grouping across countries, which addresses ongoing gene flow. Most haplotypes from Turkey were clustered around a central haplotype (AGR11), which may indicate a bottleneck effect. A haplotype previously intercepted in USA ports was identical to one sampled in Kocaeli. The present study suggests the possible ongoing intraspecific gene flow within *A. griseus* might be due to facilitated migration by the international wood trade, and the relationship between *A. griseus* and *A. sachalinensis* should be reconsidered from both morphological and molecular points of view.

Keywords: DNA Barcoding, biosecurity, international wood trade, migration, vector, pine wilt nematode.

Introduction

The intensification of international wood trade traffic in the last decades has led to an increase in threats posed by pests, diseases, and invasive species. The adopted measures and precautions, such as ISPM No. 15 (international standard for phytosanitary measures), border surveillance, and containment, successfully reducing transferring of non-native organisms at the arrival point (Allen et al. 2017). However, none of the measures and implementations can prevent invasions entirely (Hulme 2009, Haack et al. 2014). Therefore, post-border surveillance is indispensable, especially for the forests located around ports. Kocaeli province is a forested port city between the Balkan Peninsula and Asia Minor, in which a high volume of industrial wood, timber and wooden packaging materials have been

transferred, stored and processed (Çakmak et al. 2019). One of the wood-boring species that has been reported repeatedly from Kocaeli ports, timberyards and forests in the last few years is *Acanthocinus griseus* (Fabricius, 1792) (Soydabaş et al. 2017; Atak et al. 2021; Soydabaş-Ayoub and Uçkan, 2022). *A. griseus* has an essential role in the forest ecosystem by contributing to the decay process of weakened, burned, uprooted or recently felled trees. It had been a golden specimen for collectors due to its rarity during the 20th century (Lindhe et al. 2010, Cocoş et al. 2017). However, for the last two decades, *A. griseus* has fallen from grace because it is more abundant than expected (Martikainen 2002) and more harmful than previously thought (Wang et al. 2021). Nowadays, it is known that this saproxylic cerambycid has a wide range of natural distribution in Europe, from Spain, Italy, and Greece in the south to Norway, Sweden, and Finland in the north, wherever coniferous species occur (Bense 1995). It mainly condenses in weakened spruce but also inhabits standing trees. It has been noted that the beetle is a vector of pine wood nematode, *Bursaphelenchus xylophilus* (Linit 1988, Ryss et al. 2005, Wang et al. 2021), which causes critical physiological changes such as reduced photosynthesis levels and cambium destruction (Fukuda 1997). Also, it has been associated with another nematode, *Bursaphelenchus mucronatus*, sampled on the imported logs from Bulgaria at the border of Turkey and Bulgaria (Tülek et al. 2019). Moreover, the species has been reported with several port interceptions from the United States (Wu et al. 2017). However, neither intraspecific relationships within a nor migrations across countries had not been studied up to date.

One of the practical tools for post-border biosecurity surveillance is DNA barcoding using cytochrome *c* oxidase I (*COI*) gene region (Armstrong and Ball 2005, Collins et al. 2012). Furthermore, this gene region is useful for monitoring migration routes (Moritz 1994, Roderick 1996, Hurst and Jiggins 2005) and revealing inter and intra-specific phylogenetic relationships (Simon et al. 1994, Hebert et al. 2004a, Hernández-Triana et al. 2015, Paterson et al. 2016).

Therefore, in the present work, we aimed to determine native and introduced haplotypes of *A. griseus* and their phylogenetic and phylogeographic relationships, and to unveil likely cryptic speciation using the COI gene region.

Materials and methods

Sampling and Identification

The samples collected from timber yards and forests using three-funnel traps, ipsdienol and α-pinene binary combination were held in (Table 1). Morphological identification was conducted according to Bíly and Mehl (1989) and Bense (1995). The specimens were preserved at -20 °C in 99% ethanol and deposited at Kocaeli University, Turkey, Department of Biology.

DNA Isolation, PCR, and Sequencing

A piece of femur muscle of each specimen was rested overnight in the lysis buffer (2% sodium dodecyl sulfate (SDS), 3 mM $CaCl_2$, 250 µg/ml proteinase K, 8 mM dithiothreitol (DTT), 100 mM Tris buffer pH 8, and 100 mM NaCl) (Soydabaş-Ayoub 2021) and DNA isolation was performed according to Sambrook and Russell (2006). The PCRs (polymerase chain reactions) were performed for the HCO2198 – LCO1490 primer pair (Folmer et al. 1994) to amplify cytochrome *c* oxidase I (COI) gene region by BioRad CFX Connect™ thermal cycler. Quick-Load® Taq 2X Master Mix (New England Biolabs Inc.) was used with the addition of 0.08 mg/mL bovine serum albumin (Soydabaş-Ayoub 2021), 0.2 µM primer for each and around 50 ng of template DNA dissolved in ddH_2O. The thermocycling parameters were 95 °C for 1 min, 5 cycles of 95 °C for 30 s, 46 °C for 1 min and 72 °C for 1 min; then, 30 cycles of 95 °C for 30 s, 51 °C for 60 s, 72 °C for 1 min, and 72 °C for 10 min ending (Aksöyek et al. 2017).

Table 1. Voucher codes and GenBank accession numbers of *Acanthocinus griseus* specimens, their sampling dates, geographic coordinates, altitudes, and localities.

#	Voucher Code	Accession Number	Date	Coordinate	Altitude (m)	Locality
1	KOU-AG119	OP342792	01.06.2016	Lat: 40.819576, Lng: 29.493635	173	Gebze
2	KOU-AG101	OP342789	25.09.2017	Lat: 40.829273, Lng: 29.918154	460	İzmit
3	KOU-AG103	OP342791	14.05.2016	Lat: 40.827546, Lng: 29.913539	484	İzmit
4	KOU-AG130	OP342790	07.06.2017	Lat: 40.825921, Lng: 29.497796	208	Gebze
5	KOU-AG71	OP342788	28.05.2016	Lat: 40.828907 , Lng: 29.917394	426	İzmit
6	KOU-AG117	OP342794	05.06.2016	Lat: 40.788767, Lng: 29.845592	298	Derince
7	KOU-AG24	OP342793	18.07.2017	Lat: 40.827546 , Lng: 29.913539	484	İzmit

PCR products were purified using ExoSAP-IT™ PCR Product Cleanup Reagent and sequenced using BigDye Terminator v3.1 Cycle Sequencing Kit (Applied Biosystems) by ABI 3730XL DNA Analyzer (Applied Biosystems, Foster City, CA) at Macrogen Netherlands Laboratory. The sequences were uploaded to GenBank under OP342788-OP342794 accession numbers.

Genetic Diversity, Phylogenetic Analysis and Network

The chromatograms obtained by bidirectional reads were checked and assembled in Geneious Prime v2019 (Kearse et al. 2012, Biomatters Inc., USA) and blasted on GenBank. The sequences obtained in the present study (Table 1) and retrieved from GenBank and BOLD (Barcode of Life) taxonomy browsers (Table 2, Table 3) were aligned by MUSCLE v3 (Edgar 2014). The aligned dataset (658 bp) was analysed in DnaSP v6 (Rozas et al. 2017) to calculate the total number of mutations (Eta), the number of segregating sites (S), nucleotide diversity (Pi), and haplotype diversity (Hd). The uncorrected p-distances between haplotypes were calculated in MEGA X v10.0.5 (Kumar et al. 2018). The best-fitting model was determined using greedy search by PartitionFinder v2 (Stamatakis 2014, Lanfear et al. 2017) according to AICc (Akaike's information criteria corrected) for the phylogenetic analyses. The outgroups were selected among the sequences in the BOLD taxonomy browser, representing each available species of the genus *Acanthocinus* (Table 3). Maximum Likelihood (ML) analysis was performed in PhyML (Guindon et al. 2010) with the TN93 nucleotide substitution model and 10,000 bootstrap replicates. Bayesian Inference (BI) analysis was performed in MrBayes (Ronquist and Huelsenbeck 2003) with a GTR+G+I model of nucleotide substitution, 10,000,000 chain length and 10,000 subsampling frequency. The first 25% of the states were discarded as burn-in. Statistical parsimony network (TCS) (Templeton et al. 1992) was performed in PopART v1.7 (Leigh and Bryant 2015).

Results

Genetic diversity of Acanthocinus griseus

A total number of 19 haplotypes was determined among 27 sequences, 658 bp in length; seven of them were produced in this study. The guanine and cytosine (G+C) rate was 32.3%, compatible with protein-coding DNA sequences. A summary of genetic diversity statistics is presented in Table 4.

Table 2. Haplotype codes, accession IDs, and sampling localities of *Acanthocinus griseus* specimens obtained from this study and retrieved from databases

#	Haplotype Code	GenBank Accesion ID	Locality	References
1	AGR1	KY357618	Intercepted in a USA Port	Wu et al. 2017
2	AGR2	KM450656	Italy, Veneto	Rougerie et al. 2015
3	AGR3	KJ966915	Finland, Nylandia	Pentinsaari et al. 2014
4	AGR4	OP279163	Turkey, Marmara Basin	Soydabaş-Ayoub and Uçkan 2022
5	AGR5	OP342789	Turkey, Kocaeli Izmit	This study
6	AGR6	OP279164	Turkey, Marmara Basin	Soydabaş-Ayoub and Uçkan 2022
7	AGR7	KJ963896	Finland, Kainuu	Pentinsaari et al. 2014
8	AGR8	OP342788	Turkey, Kocaeli Izmit	This study
9	AGR9	KY357621	Intercepted in a USA Port	Wu et al. 2017
10		KY357620	Intercepted in a USA Port	Wu et al. 2017
11		OP279167	Turkey, Marmara Basin	Soydabaş-Ayoub and Uçkan 2022
12		OP279168	Turkey, Marmara Basin	Soydabaş-Ayoub and Uçkan 2022
13		OP279169	Turkey, Marmara Basin	Soydabaş-Ayoub and Uçkan 2022
14	AGR10	KM450534	Italy, Veneto	Rougerie et al. 2015
15	AGR11	OP342792	Turkey, Kocaeli Izmit	This study
16		OP279170	Turkey, Marmara Basin	Soydabaş-Ayoub and Uçkan 2022
17	AGR12	OP342790	Turkey, Kocaeli Gebze	This study
18	AGR13	OP342791	Turkey, Kocaeli Izmit	This study
20	AGR14	OP342793	Turkey, Kocaeli Izmit	This study
21		OP279165	Turkey, Marmara Basin	Soydabaş-Ayoub and Uçkan 2022
22		OP279166	Turkey, Marmara Basin	Soydabaş-Ayoub and Uçkan 2022
23	AGR15	OP342794	Turkey, Kocaeli Derince	This study
24	AGR16	KM441146	Italy, Veneto	Rougerie et al. 2015
25	AGR17	KU918495	Germany, Bavaria	Rulik et al. 2017
26	AGR18	KU915734	Germany, Thuringia	Rulik et al. 2017
27	AGR19	HQ559242	Finland, South Karelia	Pentinsaari et al. 2014

The interspecific distances ranged from 10.79 to 13.37%, with one exception. The distance between the AGR1 (*A. griseus*, KY357618, Wu et al. 2017) and ASA (*A. sachalinensis*, KY683654, Grebennikov et al. 2017) haplotypes was 0.3%. Their distances to other *A. griseus* haplotypes were similar and ranged between 4.71-5.47%. The intraspecific distances among remaining *A. griseus* haplotypes (ASR2-ASR12) were between 1.37-0.3%

Table 3. Binomial names, BOLD IDs and GenBank accession numbers of outgroups are used in phylogenetic analyses.

#	Species	BOLD-ID	GenBank	References
1	*Acanthocinus obliquus*	CERNO032-08		Anonymous
2	*Acanthocinus reticulatus*	PSFOR030-13	KM285803	Rougerie et al. 2015
3	*Acanthocinus aedilis*	PSFOR029-13	KM286078	Rougerie et al. 2015
4	*Acanthocinus pusillus*	CERGL150-08		Anonymous
5	*Acanthocinus nodosus*	BBCCA042-12		Anonymous
6	*Acanthocinus princeps*	CERPA269-08		Anonymous
7	*Acanthocinus sachalinensis*	VVGPL2946-15	KY683654	Grebennikov et al. 2017

Table 4. Summary of genetic diversity statistics of COI gene region (658 bp) of *Acanthocinus griseus*

Samples	n	H	Hd	SD(Hd)	Pi	SD(Pi)	S	Pin	Eta	G+C (%)
This study	7	7	1	0.076	0.00420	0.00081	8	2	8	32.3
Overall	27	19	0.957	0.028	0.00948	0.00334	50	12	53	32.3

n, the number of samples; H, the number of haplotypes; Hd, the haplotype diversity; Pi, the nucleotide diversity; Eta, the total number of mutations; S, the number of segregating sites, Pin Parsimony informative sites and SD standard deviation.

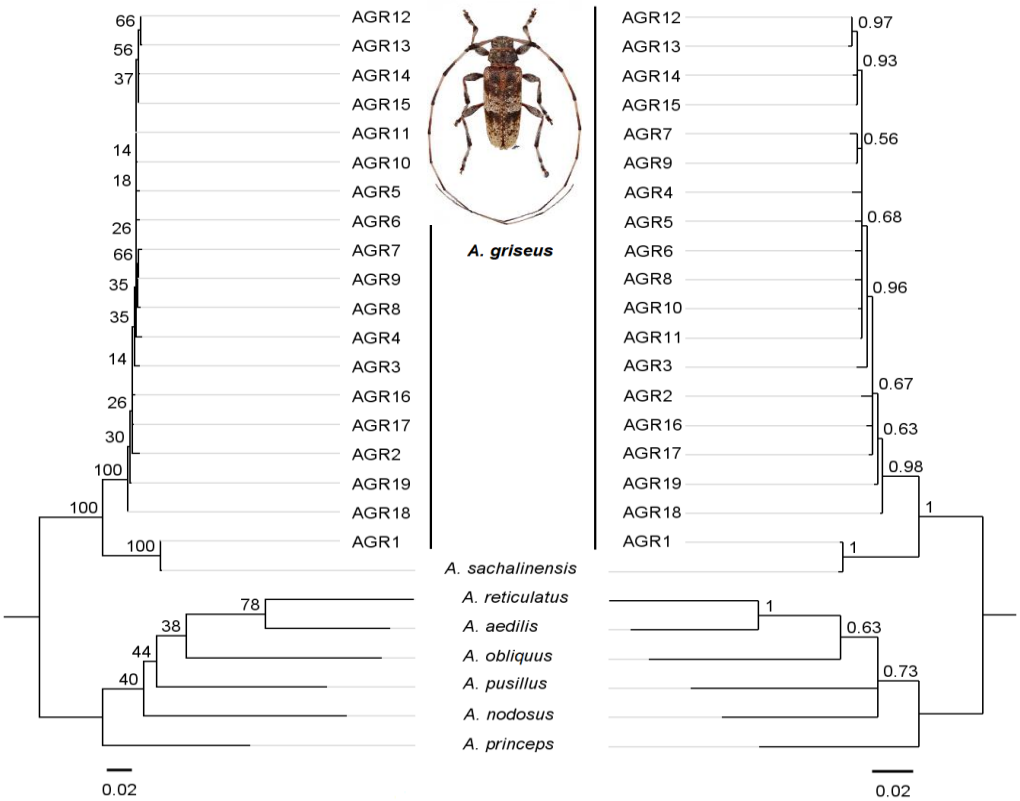

Figure 1. The phylograms inferred from Maximum Likelihood (ML) (left) and Bayesian Inference (BI) (right) analyses of 658 bp mitochondrial COI gene region of *Acanthocinus griseus* samples. The other members of the genus were used as an outgroup. Scale bars represent substation per site. Bootstrap supports of ML and posterior probabilities of BI are shown beside nodes. The photograph of *Acanthosinus griseus* is courtesy of Jean-Philippe Roguet (lamiinae.org).

.

Table 5. Uncorrected p-distances (%) between COI haplotypes of *Acanthocinus griseus* and other *Acanthocinus* species (average 5.8%)

	AOB	ARE	AAE	APU	ANO	APR	AGR1	ASA	AGR2	AGR3	AGR4	AGR5	AGR6	AGR7	AGR8	AGR9	AGR10	AGR11	AGR12	AGR13	AGR14	AGR15	AGR16	AGR17	AGR18	AGR19
AOB																										
ARE	**12.77**																									
AAE	**11.25**	**9.57**																								
APU	**12.31**	**12.01**	**12.01**																							
ANO	**11.70**	**10.79**	**12.01**	**12.46**																						
APR	**12.46**	**13.07**	**12.77**	**12.01**	**11.09**																					
AGR1	**13.22**	**13.07**	**12.77**	**12.01**	**12.16**	**11.25**																				
ASA	**13.37**	**12.92**	**13.07**	**12.31**	**12.16**	**11.25**	**0.30**																			
AGR2	12.46	11.85	11.85	11.09	10.94	10.94	**5.02**	**5.02**																		
AGR3	12.77	12.31	12.31	11.70	11.25	11.25	**5.17**	**5.17**	1.22																	
AGR4	12.61	11.70	12.16	11.09	11.25	11.25	**5.47**	**5.47**	1.37	1.06																
AGR5	12.77	12.16	12.16	11.40	11.40	11.40	**5.62**	**5.62**	1.22	0.91	0.76															
AGR6	12.31	11.70	11.70	10.94	11.25	10.94	**5.17**	**5.17**	1.22	0.91	0.76	0.61														
AGR7	12.77	11.85	11.85	11.25	11.40	11.09	**5.47**	**5.47**	1.06	1.06	0.91	0.76	0.76													
AGR8	12.31	11.55	11.55	11.25	10.79	11.09	**5.47**	**5.47**	1.06	0.91	0.76	0.61	0.61	0.61												
AGR9	12.46	11.85	11.85	10.94	11.09	11.09	**5.17**	**5.17**	0.76	0.76	0.61	0.46	0.46	0.30	0.30											
AGR10	12.61	12.01	12.01	11.25	11.25	11.09	**5.17**	**5.17**	1.06	0.76	0.61	0.46	0.46	0.61	0.46	0.30										
AGR11	12.46	11.85	11.85	11.09	11.09	11.09	**5.32**	**5.32**	0.91	0.61	0.46	0.30	0.30	0.46	0.30	0.15	0.15									
AGR12	12.46	12.01	12.01	11.40	11.25	11.09	**5.62**	**5.62**	0.91	0.91	0.76	0.61	0.61	0.76	0.61	0.46	0.46	0.30								
AGR13	12.61	12.16	12.16	11.55	11.40	11.25	**5.78**	**5.78**	1.06	1.06	0.91	0.76	0.76	0.91	0.76	0.61	0.61	0.46	0.15							
AGR14	12.77	12.16	12.01	11.40	11.25	11.09	**5.62**	**5.62**	1.22	0.91	0.76	0.61	0.61	0.76	0.61	0.46	0.46	0.30	0.30	0.46						
AGR15	12.61	12.01	12.01	11.25	11.09	10.94	**5.47**	**5.47**	1.06	0.76	0.61	0.46	0.46	0.61	0.46	0.30	0.30	0.15	0.15	0.30	0.15					
AGR16	12.77	11.85	12.16	11.40	10.94	10.79	**5.02**	**5.02**	0.91	0.91	1.06	0.91	0.91	1.06	0.91	0.76	0.76	0.61	0.91	1.06	0.91	0.76				
AGR17	12.31	12.01	12.01	11.25	10.64	10.94	**5.17**	**5.17**	0.76	0.76	0.91	0.76	0.76	0.91	0.76	0.61	0.61	0.46	0.76	0.91	0.76	0.61	0.46			
AGR18	12.31	11.55	11.70	10.79	10.94	10.64	**4.71**	**4.71**	0.91	0.91	0.76	0.91	0.61	1.06	0.91	0.76	0.76	0.61	0.91	1.06	0.91	0.76	0.61	0.46		
AGR19	12.46	11.70	11.85	10.79	10.79	10.79	**4.71**	**4.71**	0.61	0.91	0.76	0.91	0.91	0.76	0.76	0.46	0.76	0.61	0.91	1.06	0.91	0.76	0.61	0.46	0.30	

AOB: *Acanthocinus obliquus*, ARE: *A. reticulatus*, AAE: *A. aedilis*, APU: *A. pusillus* ANO: *A. nodosus*, APR: *A. princeps*, AGR. *A. griseus*, ASA: *A. sachalinensis*

Phylogenetic Analysis and Network

The phylograms inferred from ML and BI analyses of the 658 bp mitochondrial COI gene region of *Acanthocinus* samples were compatible. The outgroups showed the same clusterings. *A. reticulatus* was retrieved as a sister to *A. aedilis*. *A. princeps* was stated at the basal-most branch (Figure 1). *A. sachalinensis* were retrieved as a sister to AGR1 haplotype of *A. griseus*. Both were clustered under the *A. griseus* species group. All the remaining haplotypes were clustered together without a distinctive grouping but with polytomies.

The statistical parsimony network provided a profound understanding of intraspecific relationships of *A. griseus* haplotypes. AGR1 was 30 mutational steps away from the closest one, and a hypothetical haplotype connected AGR19 from Finland and AGR18 from Germany. Also, three more hypothetical haplotypes built a bridge to connect the haplotypes AGR 18-AGR19 to AGR3, AGR2 and AGR16, AGR17, and AGR 11 from Finland, Italy, Germany, and Turkey, respectively.

The haplotype AGR11 was at the centre of other haplotypes from Turkey, and a radial branching appeared around this haplotype. All of the haplotypes around AGR11 were from Turkey, with some exceptions. The AGR10 was only one mutational step from the central haplotype and was from Italy. In addition, the haplotype named AGR9 was sampled in Turkey in this study. It was previously reported as an intercepted haplotype in a USA port by Wu et al. (2017). Also, there were only two mutational steps between AGR9 and AGR7 from Finland.

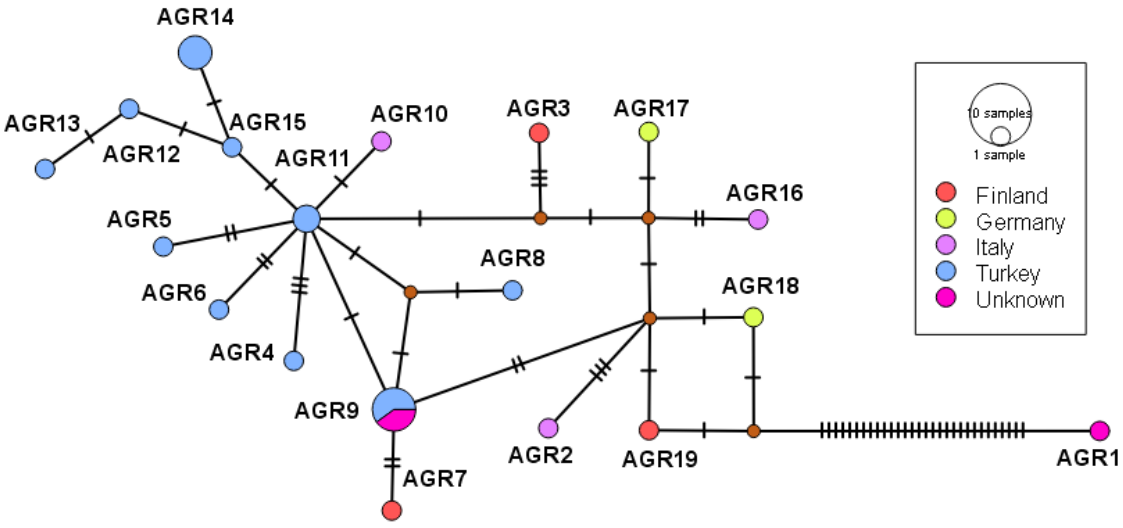

Figure 2. Statistical parsimony network of 658 bp mitochondrial COI gene region of *Acanthocinus griseus* samples. Brown points are hypothetical haplotypes. Notches on the lines indicate the number of mutations between haplotypes.

Discussion

Most wood-boring cerambycids are dispensable members of the forest ecosystem due to their role in wood decay. However, certain circumstances may turn them into invaders, such as a decrease in the

population of their predators or competitors. Also, they can be devastating pests outside their native distribution ranges if they cannot be detected, controlled and eradicated on time. For example, the polyphagous long-horned beetle *Anoplophora glabripennis* is a pest in its native range, Asia; and it has been a challenging invader in Europe, the United States and Canada since the 1990s (Wang et al. 2023). Moreover, it was detected in Zeytinburnu Istanbul province on *Acer negundo* (Ayberk et al. 2014). Another invader cerambycid, *Aromia bungii*, is a pest in its native range, east Asia, and an invader in Europe and Japan (Tamura and Shoda-Kagaya 2022). *Tetropium fuscum* is an interesting example, which is native to Europe and Northern Asia, has dominated its native congener *Tetropium cinnamopterum* in Nova Scotia, Canada (Dearborn et al. 2016). *Arhopalus rusticus*, a vector of the nematodes *Bursaphelenchus* spp., responsible for the pine-wilt disease (Ryss et al. 2005; Wang et al. 2021), inhabits both the Old and the New World naturally; however, it has been distributed to the Afrotropical Neotropical and Australian regions by human-mediated transport (Wang and Leschen 2003).

A. griseus, the guest of *Pinus, Picea, Abies*, has been evaluated as a forest pest after it had been determined as a vector of pine wilt nematode, *Bursaphelenchus xylophilus* (Linit 1988, Ryss et al. 2005, Wang et al. 2021). Moreover, it is known that this species can escape from phytosanitary measures and travel through industrial woods (Wu et al. 2017). The recent reports (Soydabaş et al. 2017; Wu et al. 2017; Tülek et al. 2019; Atak et al. 2021; Wang et al. 2021; Soydabaş-Ayoub and Uçkan 2022) revealed the potential threat posed by *A. griseus*, which point to the necessity of the post-border surveillance for early detection and rapid response. The present study is the first post-border assessment of *A. griseus*, dealing with determining native and non-native haplotypes and their relationships in the forested port city, Kocaeli Province.

The results have shown that all *A. griseus COI*-haplotypes reported from previous barcoding studies up to date from Finland (Pentinsaari et al. 2014), Italy (Rougerie et al. 2015), Germany (Rulik et al. 2017), USA (Wu et al. 2017) and Turkey (Soydabaş-Ayoub and Uçkan 2022) (Table 2) were close to each other. The intraspecific genetic distance of *A. griseus* was 1.37-0.3%, within the expected intraspecific genetic distance range of 0-3% (Hebert et al. 2003, Hebert et al. 2004a, Ward et al. 2005, Hajibabaei et al. 2006). The inter- to intraspecific distance ratio was compatible with the 10X rule (Hebert et al.2004b) because the interspecific distances ranged from 10.79 to 13.37% (Table 5).

An unexpected genetic distance value estimated between the AGR1 haplotype of *A. griseus* declared by Wu et al. (2017) and the ASA haplotype representing *A. sachalinensis* declared by Grebennikov et al. (2017), which was equal to the lowest intraspecific value, 0.3%. This estimation point to a discrepancy between morphological identification and COI barcode sequence of the AGR1 haplotype of *A. griseus*, which might be due to misidentification or cross-contamination. Nevertheless, hybridisation between two species is also possible; because both species occur in Russia. The origin of AGR1 is unclear since it was intercepted in a port in the USA (*A. griseus*, KY357618, Wu et al. 2017), but ASA (*A. sachalinensis*, KY683654, Grebennikov et al. 2017) was reported from Russia. Interspecific fertilisation cases are known for other cerambycid species, such as in *Morimus asper* complex (Solano et al. 2013), between *Cerambyx cerdo* and *C. welensii* Torres-Vila and Bonal (2019) and between *Arhopalus rusticus* and *Ar. syriacus* (Soydabaş-Ayoub et al. 2022). Or, it might be a sign of cryptic speciation, similar to other cerambycids previously revealed by Wallin et al. (2009), 11.5% distance between the siblings *Leiopus linnei* and *L. nebulosus*, and by Çakmak et al. (2020) 10% genetic distance between American and Eurasian haplotypes of *Rhagium inquisitor*, that point to allopatric speciation. Beyond all speculations, to unveil the main reasons for the unexpected genetic closeness between *A. sachalinensis* and *A. griseus* haplotypes, further studies are needed in vitro and in nature.

The polytomies were remarkable within the *A. griseus* species group at the phylograms resulting in both ML and BI analyses. Although the reasons for these polytomies could be the insufficient synapomorphic characters of the COI barcode sequences (Simon et al. 1994) or missing haplotypes of common ancestors of haplotypes (Townsend and Lopez-Giraldez 2010), a strong possibility is that their evolution occurred in a non-dichotomous manner. Because the network diagram suggested by statistical parsimony, which allows the reticular and radial branchings, provided further insight into the evolution and the phylogeographic structure of *A. griseus.* A radial grouping of Kocaeli haplotypes appeared in the network, indicating a bottleneck effect (Richards et al. 2019), and AGR11 seems to be the founder of the Kocaeli population due to its positioning at the centre of all other haplotypes. Any grouping has not appeared across European countries. The haplotypes from Finland, Italy, Germany, and Turkey were connected directly or through hypothetical haplotypes with a reticular pattern which indicates ongoing gene flow (Wollenberg et al. 2019). The shared haplotype between Turkey and USA (intercepted in the USA by Wu et al. 2017), the most sampled in this study, also supports the ongoing transfer overseas.

It is possible the conclude from our study that the ongoing gene flow occurs in *A. griseus*, which is probably facilitated by international wood trade. Therefore, regular post-border surveillance is required to recognise this potential invader and pine-wilt nematode vector before it becomes catastrophic. We also suggest further studies on the relationship between *A. griseus* and *A. sachalinensis*.

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Submitted: 05.03.2023 Accepted: 12.06.2023

Eurasian Journal of Forest Science

2023 11(2): 79-91

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

Planning of grazing management in goat breeding in massive forest fire areas (Case Study: Manavgat Forest Enterprise)

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Abstract

Turkey's forest area covers 29.44% of the country's surface, with approximately 23.1 million ha. Within these areas are approximately 20 thousand villages and 7 million forest villagers. The vital activities of forest villagers, whose primary source of livelihood is agriculture and animal husbandry, face severe damage due to forest fires. The "Regulation on the Procedures and Principles Regarding Animal Grazing in Forests and Grasslands, Pastures and Winter Pastures Located in Forests," published by the General Directorate of Forestry (GDoF), entered into force in 2012. According to this regulation, areas where grazing is prohibited and where grazing is allowed are specified. According to GDoF, cattle and sheep graze systematically in 53.1% of the forest areas of our country. However, it is unknown what kind of grazing system will be applied for forest villagers due to the burning of all areas around forest villages in mega forest fires. This study discusses the possibilities of creating a grazing plan and management for the forest villages of Manavgat district of Antalya province after a major forest fire. The study consists of field-specific data, fire data in the Manavgat district, forest management plan data, and forest village data damaged by fire at various levels. Forest villagers' most critical problem after major forest fires is the complete restriction of sustainable goat breeding. A new grazing plan and management approaches must be determined in such areas to maintain their living practices despite legal restrictions. In this study, a new grazing plan and management possibilities are discussed.

Keywords: Great Forest Fire, Forest Peasant Goat Breeding Enterprises, Planning Sustainable Grazing Management.

INTRODUCTION

Turkey has 23.1% (23.100.000.000 ha.) hectares of forest areas. Approximately 29.44% of the country's surface (78,456,200 ha.) is covered by forest areas (OGM, 2021). This data shows that forest and forestry activities occur in approximately 30% of the country. On the other hand, the population living in or near forest areas in the rural areas of our country is called "forest villagers." In our country, approximately 7 million forest villagers live in 20 thousand forest villages living in and near forests (OGM, 2021). This data shows that one out of every three villagers in our country, which means 1/3 of them are forest villagers (Coşgun, 2021). The high share of forest areas in the country in general and the fact that there is a significant number of forest villagers among the rural population living in these areas show that all kinds of work and transactions related to forest areas have or will have profound effects on forest villagers.

For this reason, forestry has an essential place in our country. The primary livelihood sources of the forest village population are agriculture and animal husbandry (Çağlar, 1986; Coşgun, 2005). The fact that agriculture and animal husbandry constitute the primary source of livelihood of the forest villagers, who include 1/3 of the population in rural areas, is essential data for the studies to be carried out in forest areas. Another phenomenon that causes severe damage to both segments in the interaction between forest villagers and forest areas is "forest fires."

Forest fires in our country are undoubtedly a natural disaster. The average number of forest fires in the last thirty-three years (1988-2021) is approximately 2.200, and the average size of the burned forest area is 14.700 ha (OGM, 2021). However, as it is known, in the history of our country, severe damages have occurred in 2021 in terms of the area burned and the number of fires. In 2021, forest fires broke out in July-August due to weather conditions (such as temperature, relative humidity, and wind speed); during this period, around 300 forest fires, 16 of which were large, broke out in our country. These fires, which mostly broke out on the borders of Antalya and Muğla provinces, negatively impacted settlements, that is, forest villagers living close to forests. Another negative impact of forest fires on forest villagers is the restriction of the forest villagers' ability to benefit from forest areas through grazing. On the other hand, the issue of goat grazing in forest areas has been a matter of debate for many years.

Law No. 6831 on Forestry, which entered into force in 1956 and is still valid, has shown the understanding of the adverse effects of goat breeding on forests in Article 19 of this law. The relevant article in the law reads, "All kinds of animals are prohibited in forests." However, with an empathetic approach for forest villagers living close to forest areas, Articles 20., 21., and 22. of the same law also show a tendency to realize the utilization of forests through grazing in a certain order. In various "Action Plans" prepared by the GDoF between 2004 and 2010, it is seen that there are approaches to the pressures on forest areas and the improvement of forest areas (Coşgun and Yolcu, 2008). The struggle of goat breeders in forest villages against all these approaches ended with regulating the issue in Article 182 of Law No. 6111, published on February 13, 2011, as "...However, in accordance with the requirements of public interest, animal grazing may be allowed in forest areas determined by the forest administration within the framework of the procedures and principles determined by the forest administration.... ". Based on this law, the "Regulation on the Procedures and Principles Regarding Animal Grazing in Forests and Grasslands, Plateaus and Winter Pastures Located in Forests and Forests," which entered into force after being published in the Official Gazette dated July 11, 2012, and numbered 28350, regulated grazing in forest areas through planning. According to this regulation, grazing plans were established by the DGoF at the national level shortly afterward. DGoF stated, "In 53.1% of the forest areas of our country, ovine and bovine animals are systematically grazed in forest areas. As a result of planned grazing, it fulfills the feed need for animal husbandry." (URL-1, 2022).

The importance of the study: The inability of forest villagers to graze in forest areas that have experienced significant forest fires threatens "sustainable goat breeding." Today, it is essential that goat breeding is sustainable in order to ensure food security and to be an economical substitute protein source. Almost all of the forest villages in the Mediterranean Region have goat breeding within the scope of animal husbandry. However, various socio-economic factors affect the sustainability of goat breeding. Ensuring the sustainability of goat breeding will also ensure the economic development of local forest villagers' goat breeding enterprises. For this reason, ensuring the sustainability of forest villager goat breeding enterprises has become crucial. Forest fires in large areas make it necessary to plan the grazing management in these areas to ensure sustainable goat breeding of forest villagers.

The study aims to set an example for providing grazing management that will allow forest villagers to raise small ruminants in areas burned after forest fires in the Manavgat Forest Management Directorate (MFMD) of Antalya Regional Directorate of Forestry in 2021.

MATERIAL and METHOD

The survey model was applied in this study. A survey model is a research approach that aims to describe a past or current situation as it exists. The individual or object that is the subject of the research is tried to be defined in its conditions and as it is. No effort is made to change or influence the variables (Karasar, 2020). In addition, Geographic Information Systems methods were utilized to prepare cartographic material for the study.

With the support of the Antalya Sheep and Goat Breeders' Association, goat breeding enterprises and small cattle assets were determined according to how the fire affected the villages.

The study determined the coordinates of the corrals used as winter quarters of 524 enterprises that were highly, moderately, and less affected by the forest fires. Semi-structured focus group meetings were held with some of these enterprises. During the meetings, the main outlines of the goat breeding enterprises' demands and expectations for sustainable grazing management were determined. On the other hand, during the focus group meetings, physical sketches of some of the transportation routes of the forest villagers' goat breeding enterprises to the areas they currently use as summer pastures were made. However, since the field controls of these routes could not be realized, they could not be presented as digital maps.

RESULTS

Results Regarding the Areas of Burnt Forests and Forest Villages

The study covers forest villages in MFMD areas of Antalya Regional Directorate of Forestry in 2021. In MFMD of Antalya Regional Directorate of Forestry, fires occurred in massive areas. The ratio of the amount of burned area (31.572 ha) to the total forest area (51.671 ha) of MFMD is 61%. In this sense, almost 2/3 of the area of a forest management directorate was destroyed. There are 43 villages affected by the fire within MFMD. Approximately 80% of the fire-affected villages in the region are located in the Manavgat region. The large forest fire in the Manavgat district of Antalya province in 2021 covered an area of approximately 320 thousand acres.

As stated by GDoF, animals were or are grazing in forest areas, corresponding to approximately 53% of the country's forest areas. While forest villagers in the MFMD areas were able to raise goats through grazing in these areas before the forest fires of 2021, it has become clear that they will not be able to use these areas for a long time (approximately 20 years) due to the large forest fires of 2021, which covered massive areas.

The forest fires in Antalya and Muğla provinces in the summer of 2021, effective in large areas, have seriously jeopardized the sustainable goat breeding of forest villagers who make a living from animal husbandry. There was no significant loss of small cattle in forest villages during the fire process. This is because this summer period corresponded to when forest villagers' goat breeding enterprises were in summer pasture areas. In other words, forest villagers who make a living from goat breeding did not experience a significant loss of livestock during the forest fires, as they mostly grazed in the highlands. The factor that jeopardizes the sustainable goat breeding of these villagers stems from their wintering location, which they utilize around their villages for about 4-5 months as wintering grounds, most of which are within forest areas. The goat breeder forest villagers, who survived the forest fire in the summer period with a significant amount of livestock loss, were faced with the situation of not being able to find a place to stay when they returned to their homes for wintering because the environment they used as winter quarters remained within the burned forest areas. In addition, due to the forest fire, there was a lack of grass for the animals to graze.

According to the observations made in the field, the vegetation in the burned areas after the fire has gradually started to be utilized for grazing. These areas, where forest villager goat breeders used to graze before the big

forest fire, are restricted to grazing due to the "Areas where grazing permission will not be granted" article of the Grazing Regulation.

Observations in the burned forest areas reveal that the forest fires that started in the borders of Manavgat and Gazipaşa districts of Antalya province have created the largest burned forest area in the history of the Republic (Table 1).

In 2021, the number of forest fires that occurred in Antalya Regional Directorate of Forestry, the distribution of the number of fires, and the amount of burned area according to the forest management directorates where the fire was effective are given in Table 1 and Figure 1.

Table 1: Distribution of forest areas burned in the primary forest fire in Antalya Regional Directorate of Forestry in 2021

Forest Enterprise Directorate	**Number of DistrictForest Rangers Affected by Fire**	**Area of Burnt Forest in Forest Management Directorates (Ha.)**
Manavgat	6	31.572,10
Taşağıl	5	9.247,60
Akseki	3	5.360,00
Gündoğmuş	4	8.675,00
Alanya	3	5.632,00
Gazipaşa	1	246,70
Total	**22**	**60.733,40**

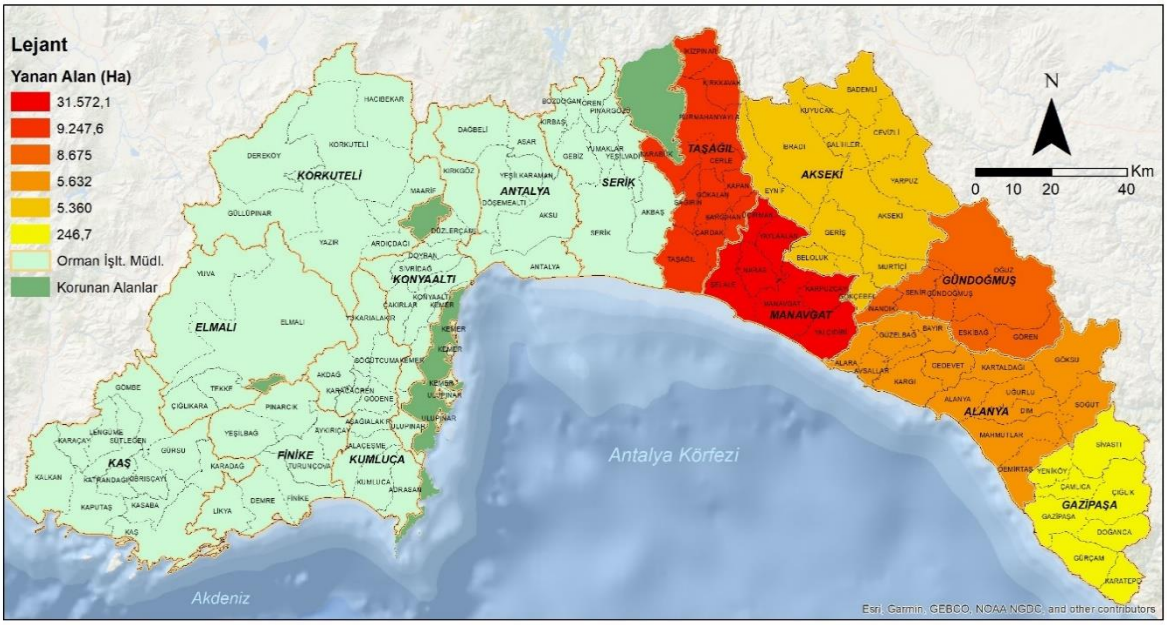

Figure 1: Distribution of forest fire areas of Antalya Regional Directorate of Forestry in 2021

Considering global climate change, there is a risk that these and similar abnormal natural events will occur more frequently in the future. For this reason, forest villagers living in close proximity to forest areas may be affected even more severely. According to the investigation in the study area, the list of villages affected by forest fires in the Manavgat district is given. The ways of being affected are categorized as *"Villages highly affected by fire," "Villages affected by the fire with moderate damage,"* and *"Villages less affected by fire"* (Table 2).

In 2021, a forest fire was effective in 41% of 106 villages in Manavgat District of Antalya province. In 2021, the total number of villages affected by the large forest fire in Antalya Forestry Regional Directorate is 54. Among these villages are 43 villages affected by the fire within MFMD. Approximately 80% of these fire-affected villages are located in the Manavgat region.

Table 2: Villages affected by forest fires in Manavgat District and how they are affected

Number	Villages Mostly Affected by Fire	Villages Affected by Fire with Moderate to Minor Damage	Villages Less Affected by the Fire
1	Ahmetler	Belenovası	Cevizler
2	Aksaz	Beydiğin	Karacalar
3	Aşağıışıklar	Çayyazı	Salur
4	Bucakşeyhler	Çeltikçi	Sevinç
5	Çardak	Çolaklı	Sırtköy
6	Dikmen	Demirciler	
7	Evrenleryahşi	Evrenseki (Evren)	
8	Gebece	Gündoğdu	
9	Hocalar	Güzelyalı	
10	Hocalı	Hacıali	
11	Kalemler	Karaöz	
12	Oymapınar	Karavca (Değirmenli)	
13	Saraçlı	Salkımevler	
14	Evrenseki (Seki)	Sarılar	
15	Tilkiler	Sülek	
16		Şişeler	
17		Taşkesiği	
18		Ulukapı	
19		Uzunkale	
20		Yavrudoğan	
21		Yaylaalan	
22		Yeniköy	
23		Yukarıışıklar	

Table 3: Distribution of goat holdings and goat assets in the villages most affected by the fire

Number	Köy Adı	Number of Goats	Number of Enterprises
1	Ahmetler	4.774	27
2	Aksaz	474	9
3	Aşağıışıklar	233	4
4	Bucakşeyhler	624	5
5	Çardakköy	4.539	29
6	Dikmen	215	2
7	Evrenleryavşi	827	4
8	Evren-Seki	0	0
9	Gebece	8.215	39
10	Hocalar	784	8
11	Hocalı	615	2
12	Kalemler	273	5
13	Oymapınar	1.565	8
14	Saraçlı	6.701	81
15	Tilkiler	971	2
Total		**30.810**	**225**

Together with the Antalya Sheep and Goat Breeders Association, examinations and evaluations were carried out in the field. In these evaluations, the number of small cattle holdings in these villages and the number of

livestock they have were determined according to the degree to which the villages were affected by the forest fire (highly affected villages, medium and less affected villages, less affected villages) (Table 3-4-5).

Table 4: Distribution of goat holdings and goat assets in villages moderately and slightly affected by the fire

Number	Villages Name	Number of Goats	Number of Enterprises
1	Belenobası	997	40
2	Beydiğin	8.563	38
3	Çayyazı	438	2
4	Çeltikçi	418	6
5	Çolaklı	258	7
6	Değirmenli	450	6
7	Demirciler	875	15
8	Evrenseki	577	6
9	Gündoğdu	561	12
10	Güzelyalı	1.393	8
11	Hacıali	318	5
12	Karaöz	938	15
13	Salkım Evler	0	0
14	Sarılar	633	15
15	Sülek	1.138	15
16	Şişeler	1.130	4
17	Taşkesiği	298	3
18	Ulukapı	2.306	44
19	Uzunkale	414	3
20	Yavrudoğan	1.238	14
21	Yaylaalan	3.073	12
22	Yeniköy	1.996	9
23	Yukarıışıklar	1.194	5
Total		**29.206**	**284**

Tablo 5: Yangından az etkilenen köylerdeki keçi işletmeleri ve keçi varlığı dağılımı

Number	Villages Name	Number of Goats	Number of Enterprises
1	Cevizler	100	1
2	Karacalar	17	3
3	Salur	1.924	5
4	Sevinçköy	1.366	5
5	Sırtköy	351	1
Total		**3.758**	**15**

In the study area, as a result of the examinations and evaluations carried out together with the Antalya Sheep and Goat Breeders' Association, the villages affected by the great forest fire in 2021 in the region and the number of goats and enterprises in these villages are presented in Figures 2 and 3 within the scope of village borders.

GDoF data shows that approximately 53% of forest areas are predominantly goat grazing. However, after the forest fires in 2021 in MFMD, a severe grazing ban was imposed on the fired areas used by forest villagers'

goat breeding enterprises for grazing. As stated by the DGoF, the management and planning of grazing are necessary for the sustainability of enterprises in goat-breeding forest villages. However, although almost 20 months have passed since the date of October 2021, which GDoF set for planning grazing in fire-damaged forest areas, it has not yet been able to enter into a study because post-fire restoration works and operations in these areas are seen as a higher priority.

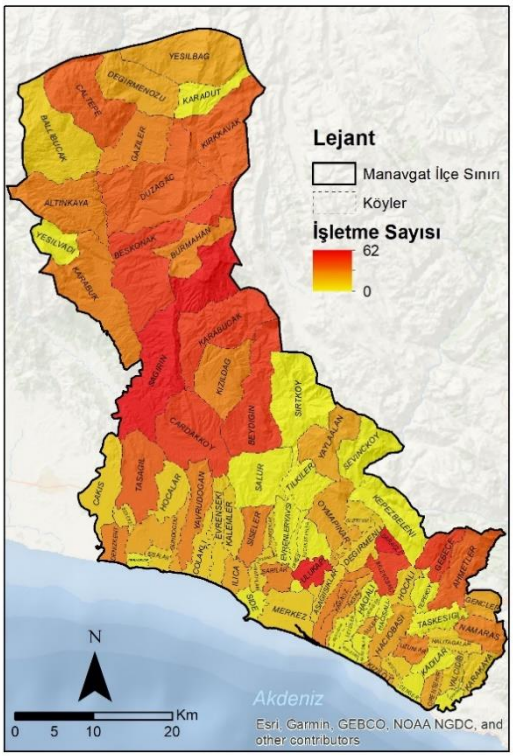

Figure 2: Number of goats affected by fire

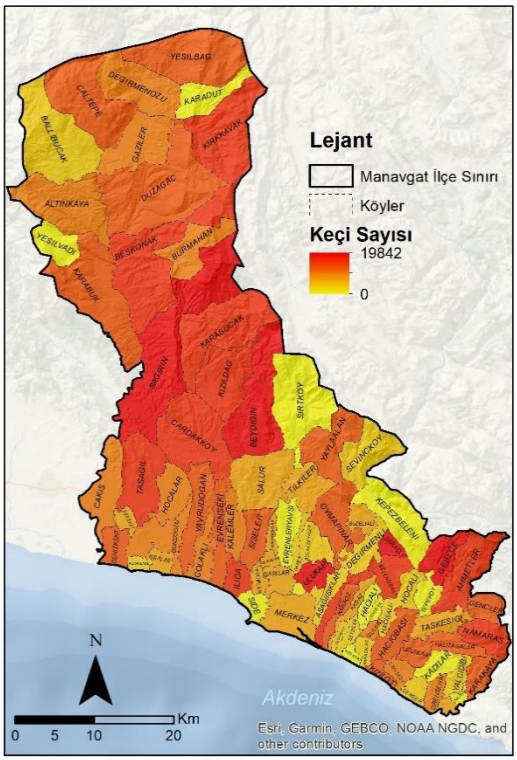

Figure 3: Number of goat farms affected by fire

3.2. Post-Fire Demands and Expectations of Forest Villagers in Burnt Areas

In the focus group meetings held in some of the villages affected by the fire, the solutions suggested by the villagers to ensure sustainable goat breeding are outlined below.

- ✓ Ensuring that some of the forest areas that were degraded (closed) before the fire can be opened to grazing,
- ✓ Since all of these areas are prohibited by the regulations after the fires, the presentation of alternative grazing areas in the nearest and suitable areas,
- ✓ Before the fire, sufficient areas around the existing corral areas (the size of which is determined depending on the presence of livestock) should be demarcated for grazing purposes, and these borders should be surrounded by barbed wire, and these areas should be allowed to be used,
- ✓ Before the fire, in the area where the existing corral areas are located, areas large enough to accommodate the animals owned in the area should be delimited and surrounded with barbed wire. Providing low-interest or grant feed loan support in order to provide feed supplementation that will ensure adequate nutrition of animals in these areas.

DISCUSSION

The fact that the forest fires that have occurred in recent years cover large areas dramatically affects the population called "forest villagers" who live intertwined with these areas. The fact that the fires also cover these villages causes the villagers to suffer loss of life and property. Restoration works to be carried out in

these areas after the fire also affect goat breeders at a much higher level, who are engaged in small cattle breeding and grazing in forest areas.
OGM states that grazing occurs in forest areas, which constitute 53% of forest areas. Despite this, the "Regulation on the Procedures and Principles Regarding Animal Grazing in Forests and Grasslands, Pastures and Winter Pastures Located in Forests and Forests," which regulates the utilization of forest areas through animal grazing, entered into force after being published in the Official Gazette dated July 11, 2012, and numbered 28350, and the "a, b, c and ç" subparagraphs of Article 4/1 paragraph of the "Basic Principles" section of the Regulation point to "areas where grazing permits will not be granted." In 2021, the forest fires experienced in massive areas in our country constituted one of the biggest obstacles to the "sustainable goat breeding" of the forest villagers who make a living with animal husbandry, especially "goat breeding."

"... Grazing directly affects the lives of forest villagers economically and socially. People engaged in animal husbandry organize their lives around the most ideal and economical way of raising their animals. Especially ovine breeding is an important activity for forest villagers in the Aegean and Mediterranean regions. It is aimed to minimize grazing damages and to ensure that forest villagers live in welfare and peace with the support of the forest organization. With the "Grazing Plans" prepared regionally in line with the regulation, grazing is carried out within a certain plan and order." The current situation of forest villagers grazing in forest areas has been determined by GDoF (URL-1, 2022). Various studies have been published to evaluate the grazing plans created following this regulation (Coşgun, 2013; Coşgun, 2014; Coşgun, 2018; Coşgun and Yılmaz, 2018). All publications show that there is planned grazing in forest areas (despite some crucial deficiencies in the plans) and that grazing practices can be carried out within the framework of regulations based on laws.

Since the settlement of man in the Mediterranean Basin, grazing has significantly impacted vegetation (Atalay, 1992). Summer drought and fires are essential to play a role in the shaping of Mediterranean vegetation (Trabaud, 1994). Grazing does not affect the spatial distribution of plants in the maquis ecosystem in the long term, but only the spatial distribution of shoots near the main plant (Papatheodorou et al., 1993). The first noticeable result of plant-animal relationships based on grazing is morphological changes in plants (Valderrábano and Torrano, 2000). According to Tavşanoğlu and Coşgun, 2009, the effect of goat grazing on the growth form of seven maquis species in pure Cupressus sempervirens forest in Köprülü Canyon National Park was investigated. Among the species analyzed, only Juniperus oxycedrus showed a significant negative relationship between the distance to the corral and grazing index values. It was suggested that this relationship was due to the fact that J. oxycedrus became more stunted as the distance to the corrals increased. This may be due to the increased preference of Juniperus individuals by goats in the vicinity of corrals where plant abundance decreased.

Several recent studies have shown that traditional goat and sheep grazing may be essential for maintaining biodiversity in Mediterranean ecosystems (Verdu et al., 2000). It has also been suggested that preventing grazing, instead of increasing plant biodiversity, may lead to the establishment of colonizing species that are not native to the area and may be considered more as noxious weeds (Lunt and Morgan, 1999). In areas with Mediterranean ecosystems, determining the animal husbandry system, i.e., the current situation, is the first step. In this context, studies such as the utilization patterns of animal breeders, plant compositions in the utilized areas, animal species and quantity, etc., have been carried out (Çelikkol and Tan, 2002; Çelikkol, 1999; Ensminger et al., 1990; Foster, 1998). On the other hand, according to Tolunay et al., 2009a and Tolunay et al., 2009b; it was determined that four goats per hectare per year could graze in the maquis of kermes oak (Qercus coccifera L.).

It is also reported that goats grazing in forest areas benefit forests, considering their grazing capacity (Xanthopoulos, 2004; Xanthopoulos et al., 2006). It has been criticized that Turkey's goat population is

decreasing without any scientific basis and ignoring the differences between regions (Gökçe, 2010). The issue of protecting and developing forests is an ecological-economic system problem on the axis of forest-peasant-business. Within this system, goats are the primary source of nutrition and livelihood of poor forest villagers and a component of ecological and economic importance (Bassullu and Tolunay, 2010; Tolunay et al., 2009c). Goat breeding is a traditional animal production branch widely practiced in underdeveloped and developing countries. This activity constitutes an important source of livelihood and food for low-income families in rural and forested areas. Another feature of this breeding branch is that marginal areas (mountainous, heathland, and stony lands) that cannot be utilized in any other way are used to obtain products such as milk and meat through goat breeding (Paksoy, 2007).

The relationship between goats and forests, damages to goats, breeding, reproduction, and inventory of goats have been included in many studies (Aldezabal and Garin, 2000; Boyazoglu and Morand-Fehr, 2001; Ainalis and Tsiouvaras, 2004; Ainalis et al., 2006; Zarovali et al., 2007). It is also seen that there are various studies such as economic analyses of goat breeding enterprises in the Antalya region, population structures, production status, labour force status, roughage source, reproduction status of goats, problems encountered in breeding, determination of a new goat breed for the region, sociodemographic lifestyles of goat breeders (Dellal, 2000; Dellal, 2000a; Dellal, 2000b; Kaymakçı et al., 2005; Kitsopanidis, 2002; Dellal and Dellal, 2005; Saatçi and Elmaz, 2017; Saatçi et al., 2016). However, studies on the demands and expectations of enterprises in ensuring the sustainability of goat breeding enterprises are limited. Ensuring the sustainability of goat breeding in forest villages in the Mediterranean Region has an important share in the development of the local people (Bekiroğlu and Tolunay, 2010a; Bekiroğlu and Tolunay, 2010b).

Goat breeding experienced a significant decline in the early 2000s. The main determining factor is the harmful effects of forestry on livestock breeding, in contrast to the high costs of feeding and other input costs and the low costs of milk and meat outputs. Restricting grazing in forests has negatively affected the high expectations of forest villagers and goat breeders from forests (Alkan and Uğur, 2015). Within the scope of goat-forest relations, it is seen that the number of goats in Turkey, which was around 19 million heads in 1980, has continuously decreased and declined to 5.1 million heads in 2009. In recent years, the number of goats has increased again with the increase in demand for goat products, especially milk, in parallel with public awareness and government incentives, and reached 10.3 million heads in 2014. The Ministry of Forestry's negative attitude towards goat grazing in and near forests has accelerated this decrease (Keskin et al., 2015).

Since grazing is done outside most of the year, goat breeding is a form of breeding with low input costs due to this structure. Forest areas constitute grazing environments for forest villagers. There are not enough studies on the effects of grazing on forest areas other than those determined by laws and regulations (Armağan, 2019). Regarding forest fires in our country, two dimensions of grazing in forests are emphasized. One is seen as a positive effect, and the other as a negative one. As a positive effect, it is emphasized that the flammable load material under the forest areas is reduced through grazing in forest areas. It is stated that with the decrease in flammable load, cover fires in forests will be less, and the severity of cover fires will be lower. As a negative effect, it is argued that fires caused by shepherds during the grazing process in forests cause fires (Göktepe and Avcı, 2015; Avcı and Korkmaz, 2021).

The burning of massive forest areas for the first time in 2021 in our country impacted the lives of forest villagers in these areas. In particular, goat breeding enterprises have become unable to benefit from the forests that they used as grazing areas before the fire after the fire. This situation has brought the local people and forestry management face to face. This situation was also experienced in the region under study, and the need for local politicians (politicians at the level of national deputies and even ministers) to intervene in the process emerged. However, no progress has been made towards solving grazing management with a new planning

approach.

Due to the effects of climate change, the frequency of forest fires, which accelerate quickly and occur in massive areas, is gradually increasing. For this reason, the sustainability of goat breeding the livelihood of the forest villagers living in these areas, has gained importance for the peace of life in the region and post-fire restoration works. This research study was designed to plan the grazing management that will ensure the sustainability of goat breeding in the forest villages of Manavgat Forest Management Directorate, where a large forest fire occurred and damaged many forest villages. However, the research, including the whole project, could not be realized due to insufficient funding. Large forest fires are continuing in our country today. Therefore, this article was prepared by taking into account the available data.

After large forest fires, economic losses should be prevented by allowing the forest villagers living in these areas to continue their grazing activities before the fire to sustain their livelihood. However, while doing this, a common interest method should be established so that the region's ecosystem is not negatively affected. For this purpose, in the first stage, it should be determined which areas can be used for grazing after the fire. Among the areas that can be utilized for grazing purposes, pre-fire degraded coppice and scrub areas of various densities should be considered first. In order to avoid various socio-political problems caused by illegal grazing in all restored areas, opening some areas for use is an agreement ground where there is a common interest for both parties (forest villagers and forestry management unit). It is important to ensure that stakeholders who can come together in common interests make joint decisions.

CONCLUSION

In Turkey, 2021 was an extremely important year in terms of forest fires. In addition to many forest fires in a short time, the largest forest ecosystems in the history of the Republic of Turkey have been burned. Therefore, in relation to post-fire rehabilitation works in large areas, it is necessary not to ignore exemplary grazing planning/management, which directly concerns the peace of life in these areas and the economic structure of the local people. There is no study to determine how the grazing management will be for the forest villager goat breeding enterprises affected by these fires after large forest fires and what to pay attention to in planning.

One of the primary sources of livelihood of forest villagers living in forest villages in the Aegean and Mediterranean regions is animal husbandry, and therefore, predominantly goat breeding. Sustainable goat breeding in forest villages requires them to utilize forest areas for wintering for 5-6 months of the year. The fact that these utilized forest areas have been subjected to fire eliminates the sustainability of goat breeding in these areas. Especially in areas where large forest fires have occurred, sustainable goat breeding for grazing purposes faces serious legal constraints. For this reason, planning grazing management in areas where large forest fires have occurred will allow forest villagers and forestry organizations to live in peace.
The "Regulation on the Procedures and Principles Regarding Animal Grazing in Forests and Grasslands, Pastures and Winter Pastures in Forests" published by OGM restricts grazing in these areas in order for the restoration works to be carried out in fire areas to be healthy. However, massive forest fires involving the general area of many villages cause severe damage to both forest ecosystems and forest villagers whose natural habitats are intertwined with forests. In this respect, they have ecological, socio-economic, and cultural impacts.

Forest fires occurring in large areas restrict the vital activities of forest villagers. Therefore, the lack of grazing areas further aggravates their living conditions. Therefore, the problem of restriction of grazing areas, which is the biggest obstacle to sustainable goat breeding of forest villagers, needs to be solved after large forest fires. However, no interest and interest group has any experience in this direction. For this reason, there is a need

for project studies to make grazing planning compatible with the rehabilitation of these areas after large forest fires.

In the study to be carried out, the coordinates of the corrals that are utilized in the current situation should be processed on the forest management plans. Thus, it will be possible to determine the level of grazing intensity within the areas to be rehabilitated after the fire. On the other hand, it will also be possible to reveal the locations of the damaged coppice areas (closed with gaps) and scrub areas in the management plans and the locations of the corral areas that can be utilized in the new situation. In light of these determinations, new corral areas must be identified by performing suitability analyses of potential corral areas for future use. The possibilities of utilizing these areas can be discussed in focus group meetings with goat breeder villagers. On the other hand, in planning rehabilitation works after large forest fires, areas of a certain size (which may vary according to the presence of livestock) around the existing corral areas can be limited and fenced with wire fences. The density of the areas that can be allowed in restoration plans and the pre-fire stand establishment structures should be considered. Low-credit or grant feed support can be provided to these enterprises according to the permitted areas' conditions and animal presence. Thus, while avoiding socio-political pressures caused by illegal grazing in all areas it will also ensure that restoration efforts' success is not hindered.

This study discusses the results of a sample project that can be achieved due to various constraints. With the rapid implementation and finalization of the projects to be developed in line with this discussion, working and living peace between forest villagers and the forestry organization can be ensured. However, unfortunately, the perception of "not being able to see the forest from seeing a single tree" continues to be a dominant behavior and perception model both in the forestry organization structure and in some scientific circles. It is a dialectical reality that restrictions enacted only by regulations will not be compatible with the practice of life.

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Submitted: 15.06.2023 Accepted: 22.09.2023

Eurasian Journal of Forest Science

2023 11(2): 92-99

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

A research on the botanical composition of Kükürtlü neighborhood (Araklı/Trabzon)

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Abstract

The study was carried out to determine the pasture status of Kükürtlü neighborhood in Araklı district of the city Trabzon. The plant samples of the study were collected in 2022. Lup method was used for specifying the vegetation data. A total of 53 taxa belonging to 44 genera and 24 families were identified in the study. Poaceae (6) and Fabaceae (4) are the richest families in the total number of taxa. The other families and taxa numbers are as follows; Apiaceae (1), Asparagaceae (3), Asteraceae (3), Boraginaceae (2), Brassicaceae (3), Caprifoliaceae (1), Caryophyllaceae (2), Ericaceae (1), Euphorbiaceae (1), Geraniaceae (2), Juncaceae (1), Lamiaceae (4), Plantaginaceae (2), Polygalaceae (2), Primulaceae (2), Ranunculus (1), Rosaceae (4), Rubiaceae (2), Scrophulariaceae (1), Orchidaceae (3), Urticaceae (1) and Violaceae (1). The status of the pasture was determined as "Poor" with a pasture quality degree of 2.01.

Keywords: Kükürtlü, Trabzon, botanical composition, pasture status.

Kükürtlü mahallesinin (Araklı/Trabzon) botanik kompozisyonu üzerine bir araştırma

Özet

Çalışma Trabzon ili Araklı ilçesi Kükürtlü mahallesinin mera durumunu belirlemek amacıyla yapılmıştır. Çalışmanın bitki örnekleri 2022 yılında toplanmıştır. Vejetasyon verilerinin belirlenmesinde Lup metodu kullanılmıştır. Toplam, 24 familya ve 44 cinse ait 53 takson tespit edilmiştir. Poaceae (6) ve Fabaceae (4) toplam takson sayısı bakımından en zengin familyalardır. Diğer familyalar ve takson numaraları aşağıdaki gibidir; Apiaceae (1), Asparagaceae (3), Asteraceae (3), Boraginaceae (2), Brassicaceae (3), Caprifoliaceae (1), Caryophyllaceae (2), Ericaceae (1), Euphorbiaceae (1), Geraniaceae (2), Juncaceae (1), Lamiaceae (4), Plantaginaceae (2), Polygalaceae (2), Primulaceae (2), Ranunculus (1), Rosaceae (4), Rubiaceae (2), Scrophulariaceae (1), Orchidaceae (3), Urticaceae (1) ve Violaceae (1) şeklindedir. Mera kalitesi derecesi 2.01 olan meranın durumu “Zayıf” olarak belirlenmiştir.

Anahtar Kelimeler: Kükürtlü, Trabzon, botanik kompozisyon, mera durumu.

Introductıon

Meadows and pastures are important areas where the feed needs of animals are met, as well as important benefits such as providing biological diversity, being a gene source for cultural plants, and protecting the soil against wind erosion.

Meadows-pasture, which make up 14.6 million hectares of Turkey's land (TÜİK, 2019), have decreased vegetation and yield potential as well as grass quality due to improper use (Gökkuş, 1991). This situation negatively affects the country's livestock and economy. In order to solve this problem, pastures with reduced grass yield and quality should be rehabilitated and made to produce high quality forage with high efficiency. However, in order to be successful in pasture improvement, it is important to know the vegetation structure of the pasture to be improved (Çınar et al., 2019). One of the studies to be done in order to know the vegetation structure well is the botanical composition studies related to the vegetation of that region.

Some floristic (Baykal and Atamov, 2016; Baykal et al., 2018; Baykal, 2019) and botanical composition determination in Rize province close to Trabzon province (Bakoğlu et al., 2019; Çatal et al., 2019; Baykal et al., 2020; Çatal et al., 2020; Bakoğlu et al., 2021) have been conducted, and there is no study to determine the botanical composition of the Kükürtlü neighborhood of Araklı district of Trabzon province. The main purpose of the study is to determine the botanical composition, pasture quality and pasture status of the Kükürtlü neighborhood.

Materıal and Method

Study area: The study was carried out in the Kükürtlü neighborhood in Araklı district of the province of Trabzon, at an average altitude of 1475 m above sea level (40 41 48.7 N; 39 55 54.4 E) and 33 km from the town, which was previously a plateau and then turned into a neighborhood. The location and photos of the study area are given in Figure 1 and 2. The average temperature and precipitation for long years were determined as 14.8 °C and 828.9 mm (Anonymous, 2022).

Method

Plant samples for identifications purposes were collected in June 2022 when the plant vegetation reached the climax phase in the Kükürtlü neighborhood of the Araklı district of Trabzon province. Three plant samples were collected for each taxon, and herbarium materials from the dried samples were prepared by using standard herbarium techniques (Erik et al., 1996). It has been taken under protection at Recep Tayyip Erdogan University Pazar Vocational School. Plant samples were identified with the help of Flora of Turkey and Aegean Islands (Davis, 1965-1985; Davis et al., 1988; Güner et al., 2000). Family, taxon (including Turkish names) and author names are given according to www.bizimbitkiler.org.tr, respectively.

Vegetation characteristics of the pasture were determined using the Lup method (Koç and Çakal, 2004) A total of 100 lup values were measured in a lup line, with a lup line of 20 m in length and a measurement distance of 20 cm between two lups. In determining the botanical composition, the plant taxon falling into each lup was recorded on the measurement scale. Plant specimens that fell into the lup were collected and identified with all their organs.

In determining the botanical composition, 5 main lines were measured, with 10 lup lines on each main line, taking into account the principles stated by Tosun (1968). The plants included in the botanical composition were given scores between -1 and 10, according to the principles stated by Gökkuş et al., (1993) and Bakoğlu (1999) and in Anonymous (2008), depending on whether the plants were evaluated as fodder, then multiplied by their ratios in the botanical composition. Pasture quality degree and status class were found by summing the values of all species (Table 1).

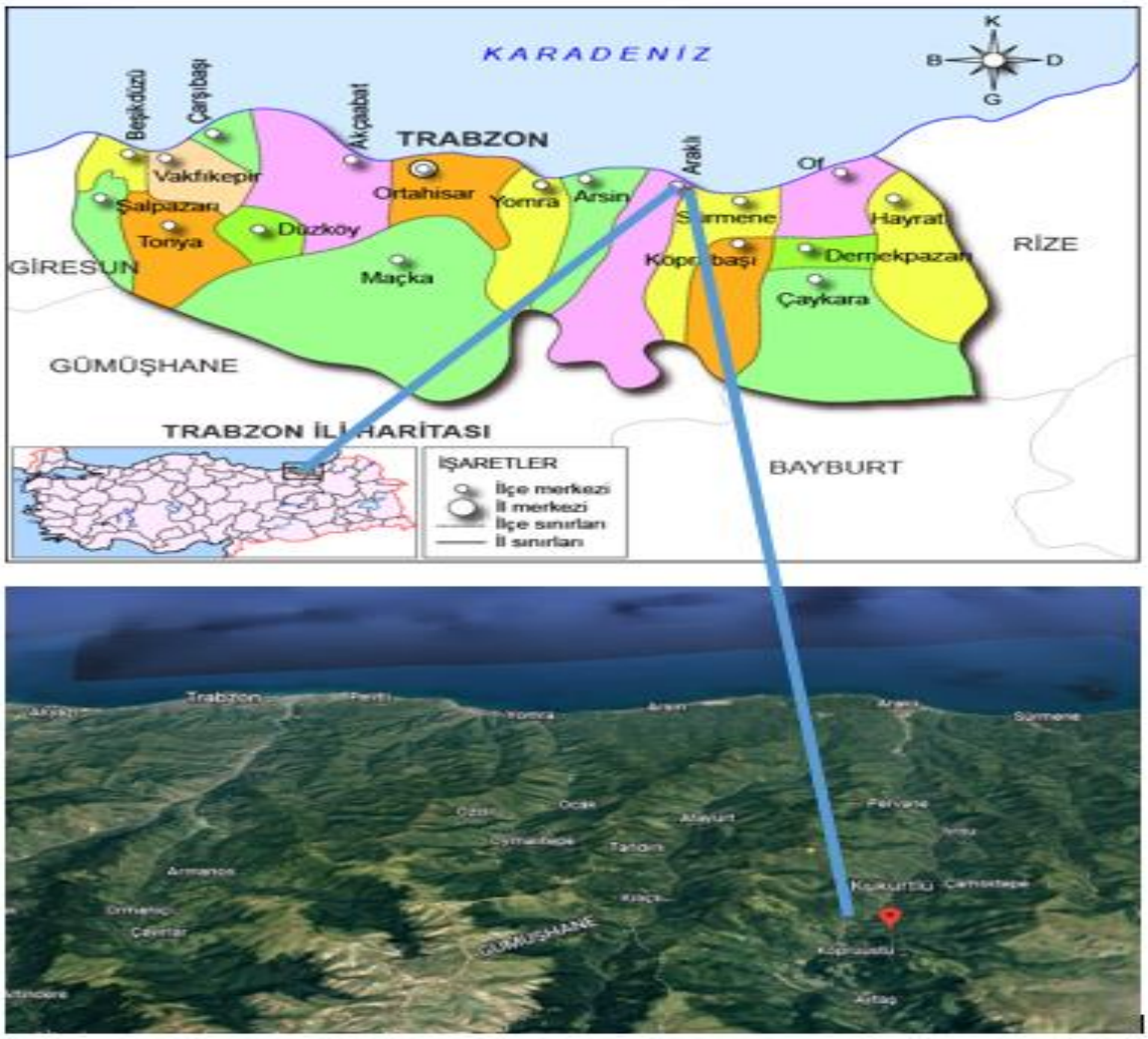

Figure 1. Location of the study area.

Table 1: Pasture Status Scale (De Vries et al., 1951)

Quality Degree	Pasture Status
8.1 – 10	Very good
6.1 – 8	Good
4.1 – 6	Middle
2.1 – 4	Poor
0.0 - 2	Very Poor

Results and Discussion

The plants most preferred by animals are delicious plants in the grasses and legumes families. For this reason, in botanical composition studies, a distinction is made as grasses, legumes and other families. The list of families, scientific and Turkish names of taxa, botanical composition ratio and pasture quality degree of the taxa in the study are given in Table 2, and the distribution of family according to the number of taxa are given in Figure 3.

A total of 53 taxa belonging to 44 genera and 24 families were identified in the study area. The richest taxa in number are Poaceae with 6 taxa, and *Fabaceae* with 4 taxa. The rest of the taxa (43) belong to the other families (Table 2).

Figure 2: Some images from the study area.

Table 2. Families, taxa name and Turkish name, value numbers, botanical composition ratios and pasture quality degree of plants in Kükürtlü,

	Family	Taxon	Turkish Name	V.N.	B.C.R	P.Q.D.
	POACEAE					
1	Poaceae	*Dactylis glomerata* L.	Domuzayrığı	7	1.00	0.07
2	Poaceae	*Festuca airoides* LAM.	Tülyumağı	4	6.00	0.24
3	Poaceae	*Poa angustifolia* L.	Darsalkımotu	5	2.00	0.10
4	Poaceae	*Poa annua* L.	Salkımotu	5	4.00	0.20
5	Poaceae	*Poa pratensis* L.	Çayırsalkımotu	7	2.00	0.14
6	Poaceae	*Poa supina* Schrad.	Sulusalkımotu	6	2.00	0.12
			Total		**17.00**	**0.87**
	FABACEAE					
1	Fabaceae	*Lotus corniculatus* L. var.	Gazalboynuzu	7	1.00	0.07
2	Fabaceae	*Trifolium medium* L. var.	Köseyonca	7	3.00	0.21
3	Fabaceae	*Trifolium pratense* L. var.	Çayırüçgülü	8	2.00	0.16
4	Fabaceae	*Vicia cracca* L. subsp. *cracca*	Kuşfiği	8	1.00	0.08
			Total		**7.00**	**0.52**
	OTHER FAMILIES					
1	Apiaceae	*Heracleum apiifolium* Boiss.	Telehaş	1	4.00	0.04
2	Asparagaceae	**Muscari aucheri* (Boiss.) Baker	Gökmüşkürüm	0	4.00	0.00
3	Asparagaceae	*Ornithogalum orthophyllum* Ten.	Bayıryıldızı	0	1.00	0.00
4	Asparagaceae	*Polygonatum multiflorum* (L.)	Mührüsüleyman	1	2.00	0.02
5	Asteraceae	*Anthemis cretica* L. subsp. *albida*	Akçabaş	2	2.00	0.04
6	Asteraceae	*Bellis perennis* L.	Koyungözü	2	5.00	0.10

Table 2 (continued). Families, taxa name and Turkish name, value numbers, botanical composition ratios and pasture quality degree of plants in Kükürtlü,

7	Asteraceae	*Pilosella hoppeana* (Schult.)	Saplıtırnakotu	0	1.00	0.00
8	Boraginaceae	*Myosotis alpestris* F.W.Schmidt	Boncukotu	0	3.00	0.00
9	Boraginaceae	**Symphytum sylvaticum Boiss.*	Tomara	0	1.00	0.00
10	Brassicaceae	*Capsella bursa-pastoris* (L.)	Çobançantası	2	1.00	0.02
11	Brassicaceae	*Draba hispida* Willd.	Kıllıdolama	0	2.00	0.00
12	Brassicaceae	*Draba huetii* Boiss.	Çayırdolaması	0	1.00	0.00
13	Caprifoliaceae	*Valeriana alliariifolia* Adams	Pisot	-1	2.00	-0.02
14	Caryophyllaceae	*Arenaria serpyllifolia* L. subsp.	Titrekkumotu	2	1.00	0.02
15	Caryophyllaceae	*Cerastium purpurascens* Adams	Alacaboynuzotu	3	2.00	0.06
16	Ericaceae	*Vaccinium myrtillus* L.	Ayıüzümü	1	1.00	0.01
17	Euphorbiaceae	*Euphorbia amygdaloides* L.	Zerana	-1	1.00	-0.01
18	Geraniaceae	*Geranium molle* L.	Yumuşakıtır	2	1.00	0.02
19	Geraniaceae	*Geranium psilostemon* Ledeb	Zarifıtır	2	1.00	0.02
20	Juncaceae	*Juncus effusus* L.	Cilotu	0	2.00	0.00
21	Lamiaceae	*Ajuga reptans* L.	Meryemsaçı	0	1.00	0.00
22	Lamiaceae	*Salvia verticillata* L. subsp.	Dadırak	1	1.00	0.01
23	Lamiaceae	*Stachys macrantha* (K.Koch)	Kocasoğulcan	2	2.00	0.04
24	Lamiaceae	*Thymus longicaulis* C.Presl	Aşkekiği	2	1.00	0.02
25	Plantaginaceae	*Plantago lanceolata* L.	Damarlıca	2	3.00	0.06
26	Plantaginaceae	*Veronica gentianoides* Vahl	Kandilçiçeği	1	1.00	0.01
27	Polygalaceae	*Polygala alpestris* Rchb.	Yaylasütotu	1	1.00	0.01
28	Polygonaceae	*Rumex alpinus* L.	Şortah	0	1.00	0.00
29	Primulaceae	*Primula aucalis* (L.)L. acucalis	Çuhaçiçeği	0	1.00	0.00
30	Primulaceae	*Primula elatior* subsp. *pallasii*	Sarıtutya	0	2.00	0.00
31	Ranunculus	*Ranunculus repens* L.	Tiktakdana	-1	2.00	-0.02
32	Rosaceae	*Alchemilla daghestanica* Juz.	Dağpençesi	1	5.00	0.05
33	Rosaceae	*Alchemilla sintenisii* Rothm.	Supençesi	1	1.00	0.01
34	Rosaceae	*Potentilla crantzii* (Crantz)	Beşparmakotu	0	1.00	0.00
35	Rosaceae	*Sibbaldia parviflora* Willd. var.	Fındıkotu	1	3.00	0.03
36	Rubiaceae	*Asperula arvensis* L.	Tarlabelumotu	0	5.00	0.00
37	Rubiaceae	*Galium incanum* Sm. subsp.	Külahiplikçiği	1	1.00	0.01
38	Scrophulariaceae	*Scrophularia nodosa* L.	Tavuksıracası	1	1.00	0.01
39	Orchidaceae	*Dactylorhiza euxina* (Nevski)	Lazsalebi	2	1.00	0.02
40	Orchidaceae	*Dactylorhiza urvilleana*	Balkaymak	2	1.00	0.02
41	Orchidaceae	*Orchis ustulata* L.	Katranalacası	0	1.00	0.00
42	Urticaceae	*Urtica dioica* L. subsp. *dioica*	Isırgan	2	1.00	0.02
43	Violaceae	*Viola sieheana* W.Becker	Çayırmenekşesi	0	1.00	0.00
			Total		**76.00**	**0.62**
			GENERAL TOTAL		**100.00**	**2.01**

*:Endemic, V.N.: Number of Value, B.C.R: Botanical Composition Ratios, P.Q.D: Pasture Quality Degree

Botanical composition ratios of Poaceae, Fabaceae, and other families are 17.00%, 7.00%, and 76.00%, respectively. With a pasture quality rate of 2.01, the status of the pasture was determined as "Poor". In our study, the low feed value of the plants in the area may have affected the poor pasture condition of the study area. Among the plants in the botanical composition, *Festuca airoides* (6%) from Poaceae, *Trifolium medium* var. *medium* (3%) from Fabaceae, and *Bellis perennis* (5%), *Alchemilla daghestanica*

(5%), *Asperula arvensis* (5%) from other families constitute the first rank. In addition, 2 endemic taxa *Muscari aucheri* and *Symphytum sylvaticum* are identified in the study area (Table 2).

Number of taxa according to families: Poaceae (6), Fabaceae (4), Apiaceae (1), Asparagaceae (3), Asteraceae (3), Boraginaceae (2), Brassicaceae (3), Caprifoliaceae (1), Caryophyllaceae (2), Ericaceae (1), Euphorbiaceae (1), Geraniaceae (2), Juncaceae (1), Lamiaceae (4), Plantaginaceae (2), Polygalaceae (2), Primulaceae (2), Ranunculus (1), Rosaceae (4), Rubiaceae (2), Scrophulariaceae (1), Orchidaceae (3), Urticaceae (1), Violaceae (1) (Table 2).

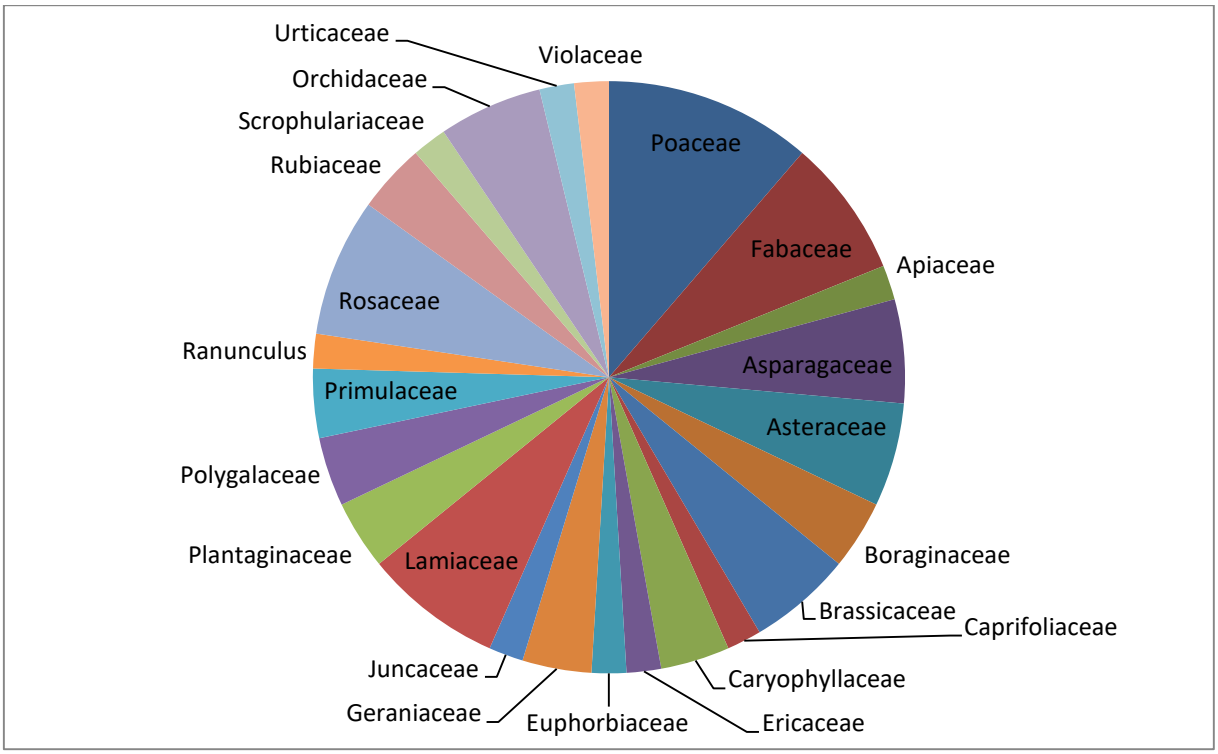

Figure 3. Distribution of family according to the number of taxa

There are some studies in Rize (Bakoğlu et al., 2019; Çatal et al., 2019; Baykal et al. , 2020; Çatal et al., 2020; Bakoğlu et al., 2021) on botanical composition and pasture status which are close to the study area. Bakoğlu et al., (2019) reported the ratio of soil coverage (82.4%), grasses (33.37%), legumes (5.75%), and other families (60.88%,) and poor pasture status with a value of 2.456 within Handüzü plateau; On the other hand Çatal et al., (2019) indicated, the soil coverage (63.4%) the ratio of grasses (39.35%), legumes (6.61%), and other families (54.04%) in a very weak pasture status with a range of 1.976 in Ovit plateau. Baykal et al., (2020) determined soil coverage rate (70.75%), proportion of grasses (54.98%), legumes (2.88), other families (42.14%) and a weak pasture status with the value of 2.383in Palovit plateau. Çatal et al., (2020) defined the soil coverage (79.15%), the ratio of grasses (21.24%), legumes (13.66), and other families (65.10%) within the weak pasture status with a pasture grade of 2.365 in Trovit plataeu; Bakoğlu et al., (2021) clarified the soil coverage rate (83.40%), ratio of *Poaceae* (13.07%), *Fabaceae* (28.11%) other families 58.82% a weak pasture with the data 2.65.

There are similarities between the results obtained from the study and the findings of other researchers (Bakoğlu et al., 2019; Çatal et al., 2019; Baykal et al., 2020; Çatal et al., 2020; Bakoğlu et al., 2021). The fact that the rate of species from other families that are not preferred by animals is very high, affects this result. The low pasture status in the previous studies carried out with the loop method in the close geography may have been caused by the low value numbers of the species.

Conclusıon

As a result, in the study, a total of 53 taxa belonging to 24 families, 6 Poaceae, 4 Fabaceae and 43 plants from other families, were identified. Botanical composition ratios were determined as Poaceae (17.00%), Fabaceae (7.00%) and other families (76.00%). With a pasture quality rating of 2.01, the status of the pasture was determined as "Poor". Efforts should be made to improve the pasture area, which is in a poor condition, with the improvement method.

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Submitted: 19.10.2022 Accepted: 13.07.2023

Eurasian Journal of Forest Science

2023 11(2): 100-115

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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).

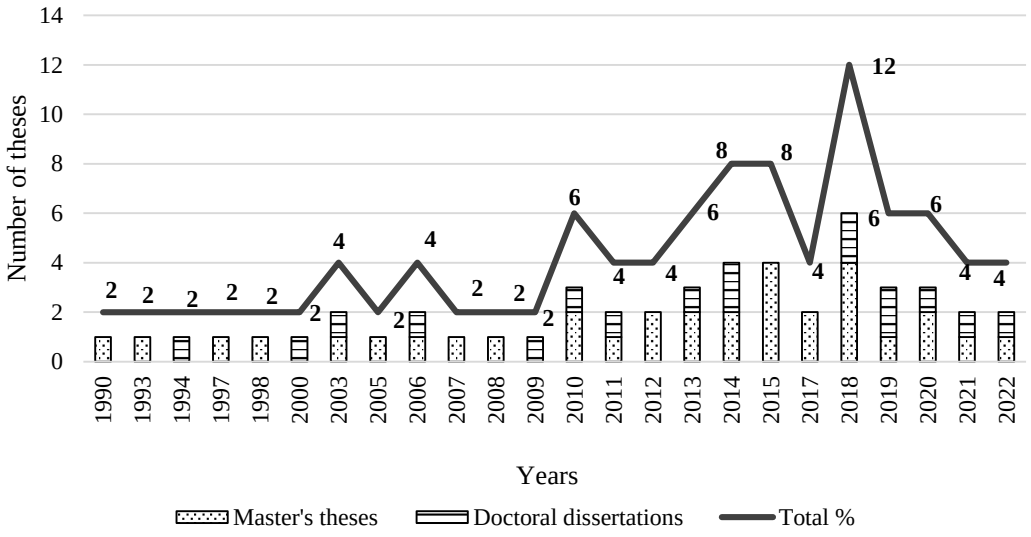

Figure 1. Distribution of postgraduate theses related to wood anatomy based on years.

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.

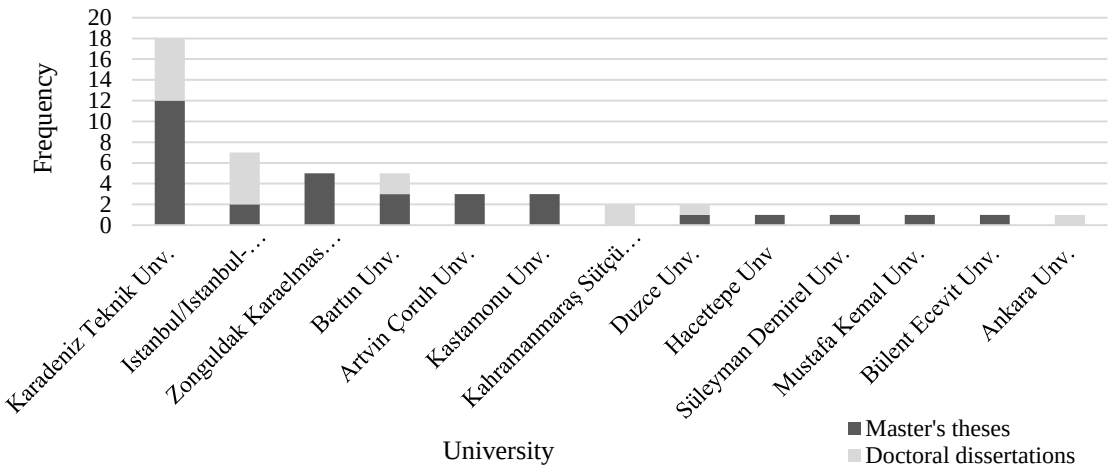

Figure 2. Distribution of postgraduate theses related to wood anatomy based on universities.

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).

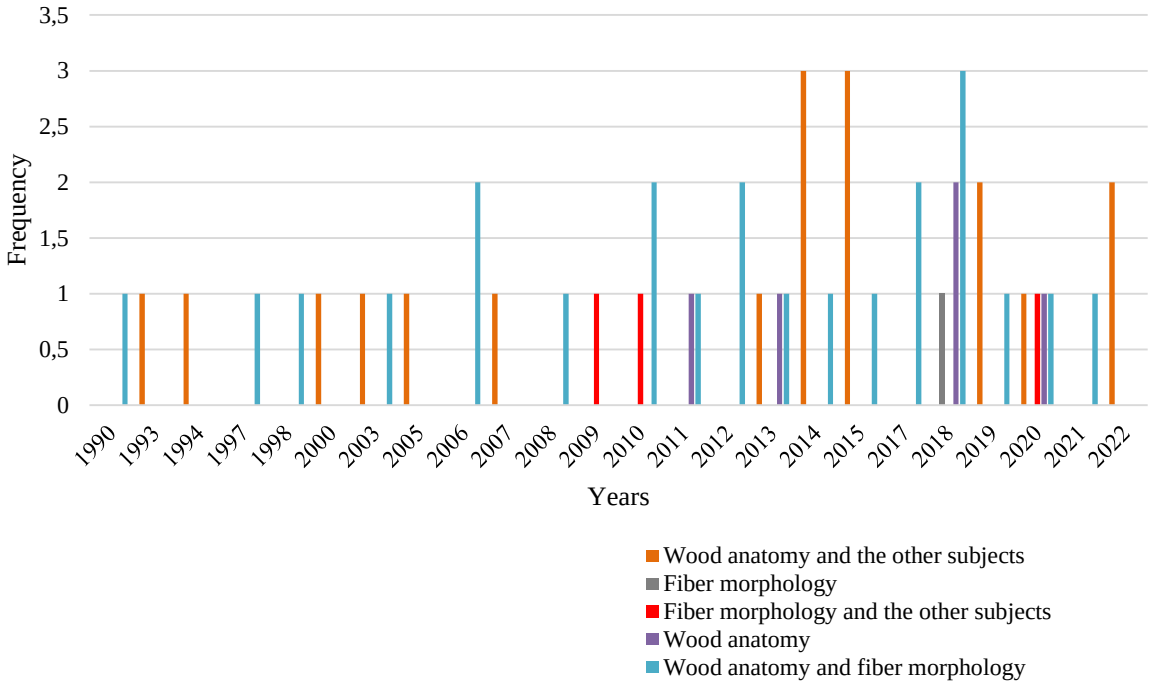

Figure 3. Distribution of postgraduate theses related to subjects based on years.

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.

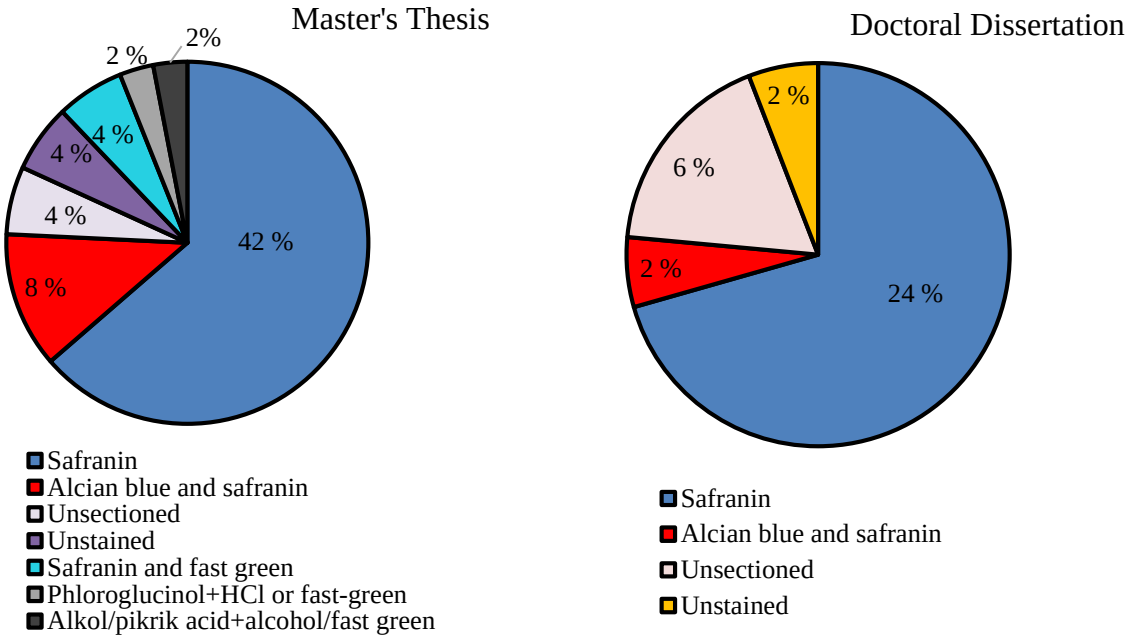

Figure 4. Distribution of stains used in postgraduate theses.

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