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Monofloral honey is a particular kind of honey that is made mostly from the nectar of a single plant species by honeybees, giving it a unique flavor, color, and scent. The purpose of this research was to determine the melissopalynological and physicochemical characteristics of monofloral linden honey produced in Yenice-Karabük, which has economic potential in both the Turkish and EU markets. For those objectives, 54 honey samples that were produced in 13 distinct areas throughout the Yenice region in 2018 and 2019 were analyzed. A total of 87 species from 37 families were identified in the honey samples gathered from the area as a result of the melissopalynological study. Out of 54 honeys produced in the region, 8 of them are dominant, 7 of them are secondary, 24 of them are minor, and 8 of them consist of a trace amount of Tilia pollen. However, none of the Tilia pollens were found in the other seven samples. It was found that 10 g of honey had an average of 22.174 ± 27.024 total pollen. In honey samples, the following parameters were evaluated: proline 665.955 ± 210.527 mg/kg, free acidity 37.57 ± 11.74 , water-insoluble substance 0.0344 ± 0.038 g/100 g, G + F 68.45 ± 4.90 g/100 g, sucrose 1.70 ± 0.53 g/100 g, humidity $17.60 \pm 1.24\%$, pH 4.08 ± 0.254 , electrical conductivity 0.873 ± 0.169 mS/cm, HMF $4,409 \pm 2,020$ mg/kg, and ash $0.288 \pm 0.068\%$. The elements that were identified in the honey samples were K> Mg> Na> Ca> Fe> Zn> Mn> Ni> Ba. The electrical conductivity, pH, proline, and free acidity values could potentially be utilized as determining factors at a rate of 86.893% in the differentiation of honeys according to Tilia pollen rates, according to the results of the assessment of the physicochemical analysis parameters using PCA. Na, Mg, and Mn element quantities have been determined to account for 85.6% of determining characters.



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Integrated Palynological and Physicochemical Characterization of Tilia Honey

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Outline

Introduction

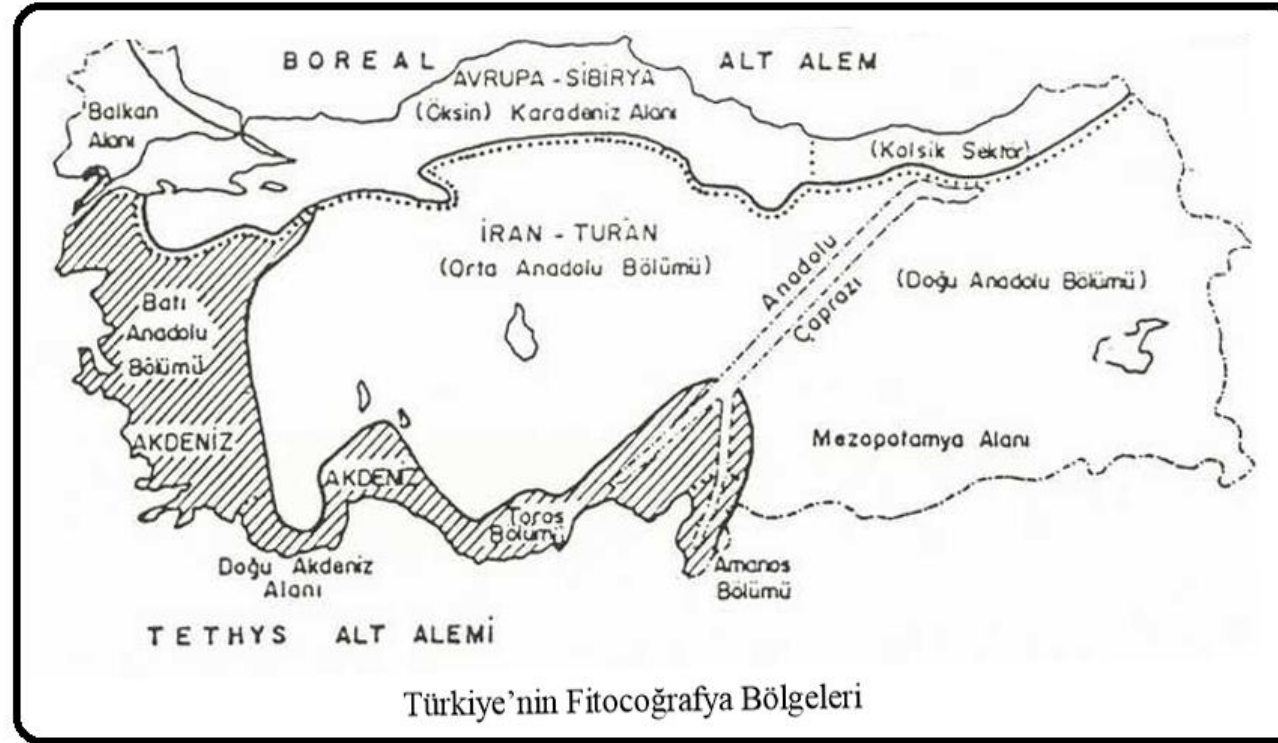
Research aim

Materials and Methods

Results and Discussion

Conclusion

Introduction



- A total of **11,707 taxa** have been identified in Turkey's flora, of which 3,649, or approximately **31.82%**, are **endemic** (Güner et al., 2012).
- It is known that approximately **450 taxa** in Turkey's flora, both natural and cultivated, are important for beekeeping as sources of nectar and pollen (Sorkun, 2008).

Introduction

- Türkiye is an important gene pool for bee breeds and ecotypes as well as floral diversity (Güler and Kaftanoğlu, 1999) and is home to many bee breeds and ecotypes that can adapt to different ecological conditions (Saygin Alparslan and Demirbaş, 2019).
- The **Anatolian honey bee** is found in Central Anatolia, the **Caucasian honey bee** in North-Eastern Anatolia, the **Yığılca honey bee** in the Düzce region, the **Gökçeada honey bee** in the Gökçeada region, the **Muğla honey bee** on the Aegean coast, the **Iranian honey bee** in South-Eastern Anatolia, the **Syrian honey bee** in the Hatay region, and the **Carniolan honey bee** in the Thrace region (Güler and Kaftanoğlu, 1999; Okumuş et al., 2012).



Kafkas



Muğla



Trakya



Güneydoğu

Introduction

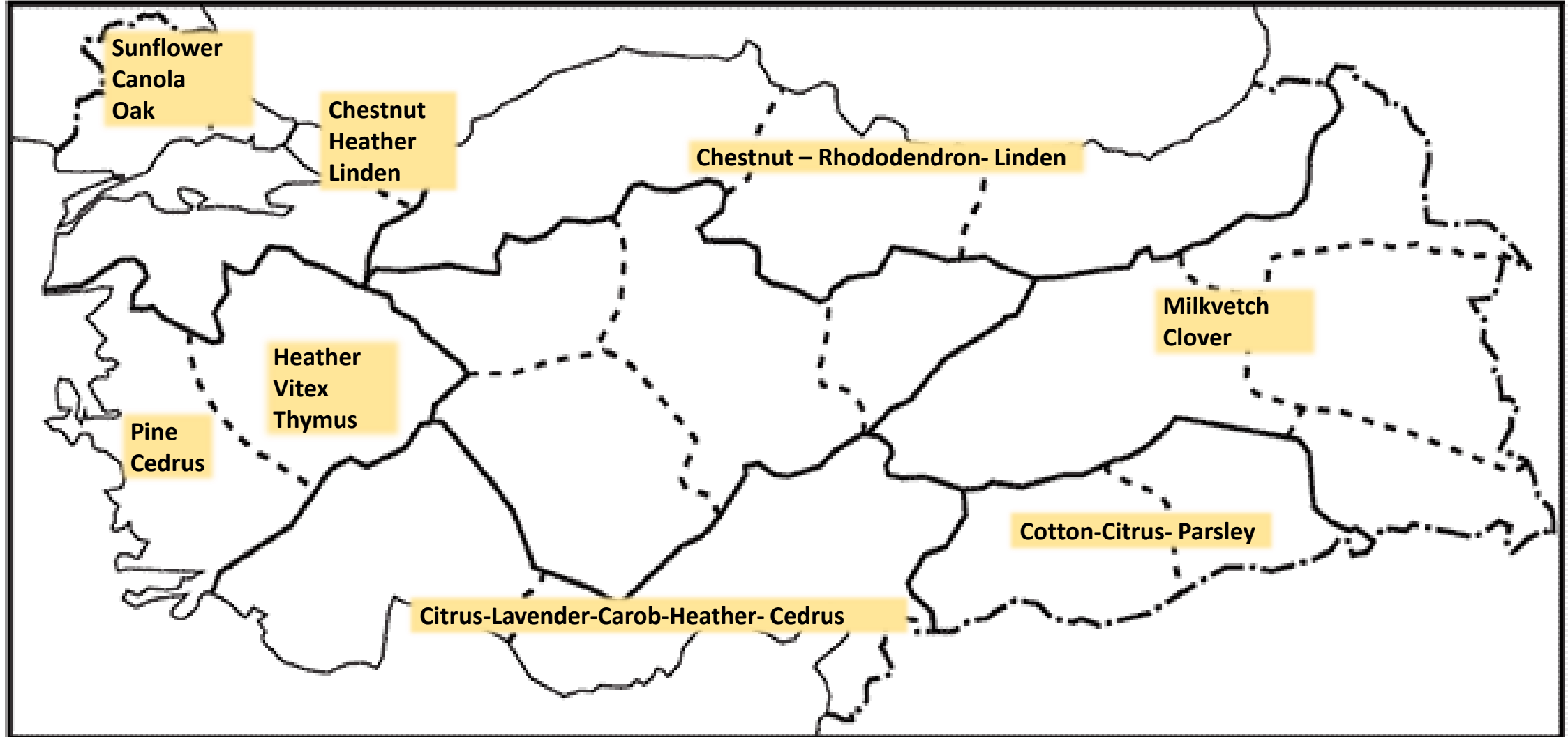
- Monofloral honey is a particular kind of honey that is made mostly from the nectar of a single plant species by honeybees, giving it a unique flavor, color, and scent.
- Many monofloral honeys are produced in different regions of Türkiye, each with different botanical origins, distinguished by their taste, aroma and therapeutic properties.



Introduction

- Although honey usually has a similar structure, **no two honeys are exactly the same**. Their composition and bioactive properties change depending on the nectar used by bees, the climate, and the geography of the region (Anjos et al., 2021; Crane, 1990; Von Der Ohe et al., 2004).
- In particular, the **smell, taste, colour** and **aroma** characteristics can be directly influenced by the botanical origin of the honey. (Cuevas-Glory et al., 2007; Kaya et al., 2005; Sahinler ve Kaya, 2001).

Monofloral Honey in Türkiye



- Although the variety and production capacity of monofloral honey produced in Türkiye is high, there is very little comprehensive scientific research on the identity, quality and chemical components of our monofloral honeys.



Research Aim

1

Melissopalynological
Analysis



2

Physicochemical
Analysis

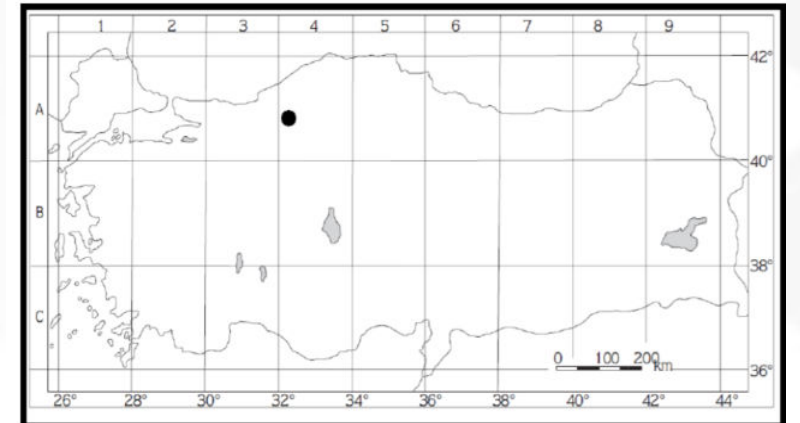
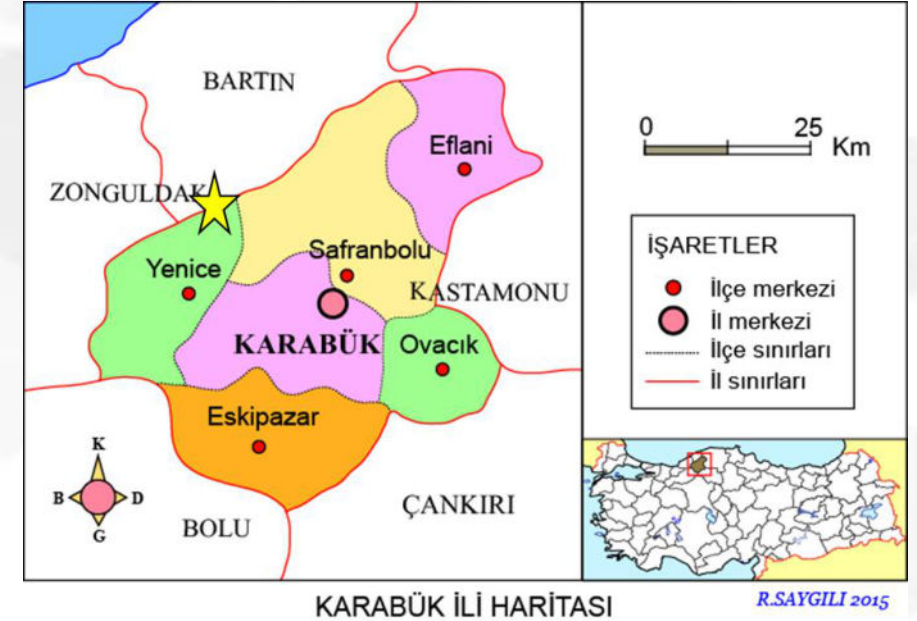
The purpose of this research was to determine the melissopalynological and physicochemical characteristics of monofloral linden honey produced in Yenice-Karabük, which has economic potential in both the Turkish and EU markets.

Material and Methods

Research Area

Karabük Province is geographically located in the western of the Black Sea Region and phytogeographically in the European-Siberian region's Oksin province. It is also located within square A4 according to Davis' grid system.

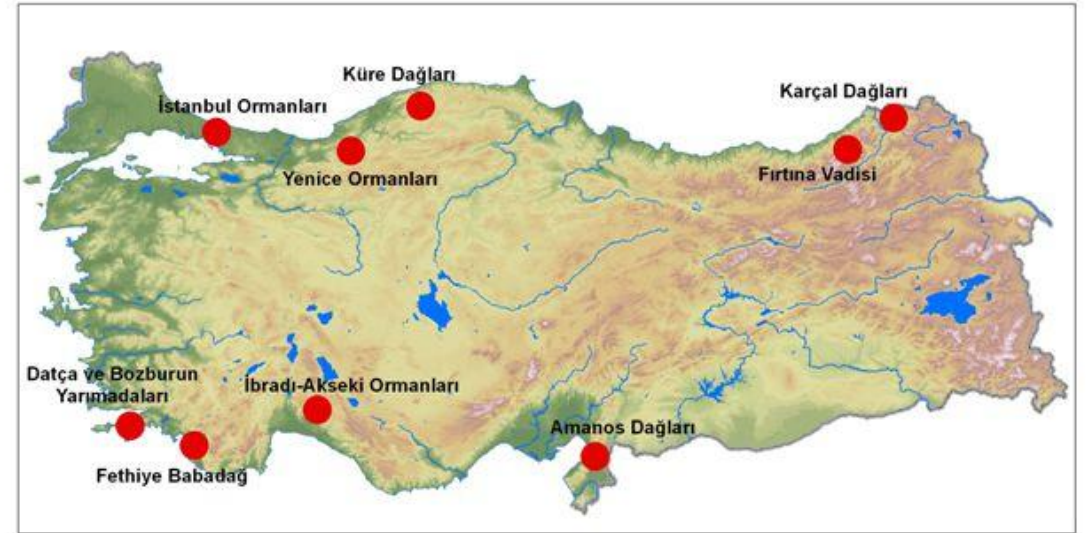
65.48% of the Karabük and **87%** of Yenice province is covered by forests.



Material and Methods

Research Area

The World Wide Fund for Nature (WWF) identified Yenice Forests as one of the "100 hot spots to be urgently conserved in Europe" in 1999.



Material and Method

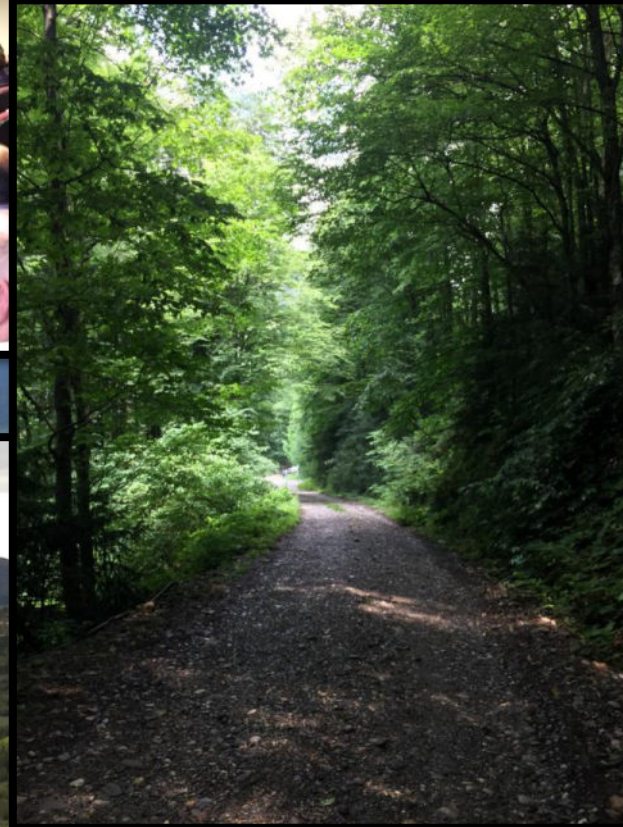
- The total of **54 honey samples** used in the study were obtained in 2018 and 2019 with the contribution of the Yenice District Directorate of Agriculture and Forestry.

Village	2018/1 number of honey sample	2018/2 number of honey sample	2019 number of honey sample
Akmanlar	2	1	1
Derebaşı	2	3	2
Değirmenyanı	-	1	1
Esenköy	1	1	1
Gökbek	1	1	1
Güney	1	1	1
Hisar	2	2	2
İsmetpaşa Mh.	-	-	1
Kayaarkası	2	2	2
Kuzdağ	1	3	2
Satuk	2	-	1
Yamaç	2	2	2
Yazıköy	1	1	2
TOTAL	17	18	19



Material and Method

Honey

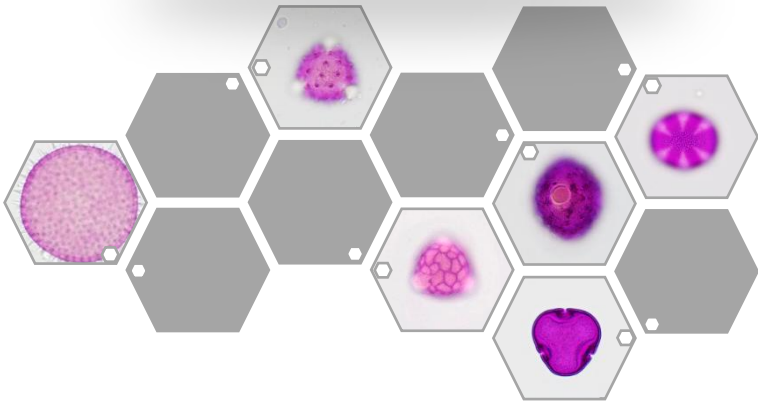


Material and Method

Melissopalynological Analysis



- Botanical origin of honey samples determined by the methodology of Louveaux et al., (1978) without acetolysis.
- 10 g of honey was dissolved in distilled water, the sugars were removed, and the pollen content was precipitated by centrifugation.
- Then the sediment was mounted with the fuchsin-stained glycerin gelatine.
- For evaluating the relative abundance of each pollen type, at least **500 pollen grains** were counted on each slide.



Material and Method

Melissopalynological Analysis

- The preparations for calculating the Total Pollen Number (TPN-10g) were prepared according to the method developed by Moar (1985).



Material and Method

Plant collection for reference slides

- The reference pollen preparations of the identified plants were prepared using the Wodehouse method (Wodehouse, 1935).



Rubus sanctus



Onopordum acanthium



Hypericum perforatum



Echium vulgare



Clematis vitalba



Sambucus ebulus

Material and Method

Physicochemical Analysis

- Harmonised methods accepted by the International Honey Commission have been used for electrical conductivity, diastase moisture, pH, proline, free acidity, HMF and sugar analyses (Bogdanov et al., 2002).



**HARMONISED METHODS OF THE
INTERNATIONAL HONEY COMMISSION**
<http://www.bee-hexagon.net/en/network.htm>

IHC responsible for the methods:
Stefan Bogdanov, Bee Product Science, www.bee-hexagon.net

send feed-back to: info@bee-hexagon.net

Material and Method

Elemental Analysis

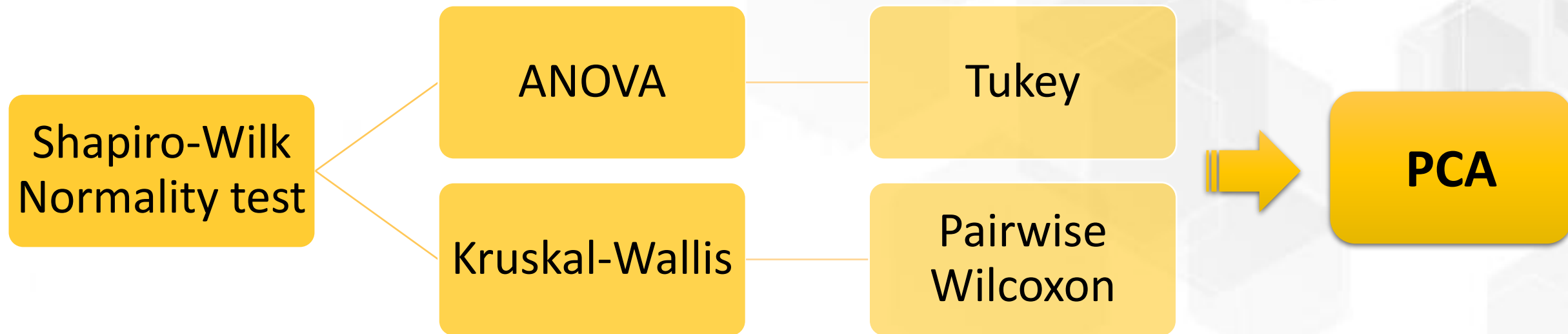
- Elemental analysis carried out by the methodology of Oroian et al. (2015).



Material and Method

Statistical Analysis

Statistical analysis were performed using the R programming language in the RStudio interface (R Core Team, 2013) ($p < 0.05$).





RESULTS & DISCUSSION

Melissopalynological Analysis

Taxa	Number of samples	% Frequency of occurrence	Frequency classes
Rosaceae	49	91	very frequent
<i>Tilia</i> spp.	47	87	very frequent
<i>Sambucus</i> spp.*	45	83	very frequent
<i>Cistus creticus</i> *	44	81	very frequent
<i>Clematis vitalba</i>	43	80	very frequent
<i>Paliurus spina-christi</i>	42	78	very frequent
<i>Castanea sativa</i>	36	67	very frequent
<i>Erica</i> spp.	34	63	very frequent
<i>Rosa canina</i>	34	63	very frequent
<i>Crataegus</i> spp.	33	61	very frequent
Fabaceae	28	52	very frequent

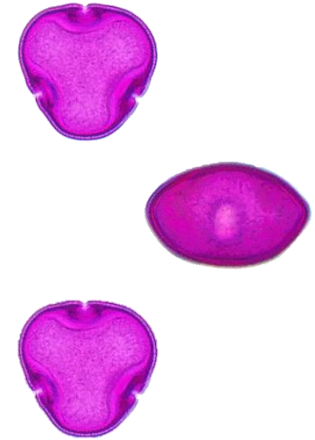
very frequent (>%50), frequent (%20-50), infrequent (%10-20) (Feller-Demalsy et al., 1987)

A total of **87 taxa** belonging to **37 families** were identified in the honey samples.

Melissopalynological Analysis

Total 54 honey samples;

- 8 samples have **dominant** *Tilia* pollen
- 7 samples have **secondary** *Tilia* pollen
- 24 samples have **minor** *Tilia* pollen
- 8 samples have **rare** *Tilia* pollen



❖ No *Tilia* pollen in 7 samples



- ❖ Other taxa with **dominant** pollen: *Erica* spp., *Castanea sativa*, *Sambucus* spp., and Rosaceae.
- ❖ Taxa with **secondary** pollen: *Erica* spp., Rosaceae, *Clematis vitalba*, *Crataegus* spp., *Sambucus* spp., *Castanea sativa*, *Paliurus spina-christi*, *Cistus creticus*, *Ligustrum* spp.

Tilia Honey

- Various researchers have reported that linden honey has a low pollen content and that monofloral linden honeys are represented by a small number of pollen grains (Adams ve Smith, 1981; Corvucci et al., 2015; Faegri ve Iversen, 1989).
- In this study, Tilia pollen ranged between **0.50%** and **69.71%**.

66%

66%

27%

Türk Taram – Gıda Bilim ve Teknoloji Dergisi, 4(12): 1123-1126, 2016

 Türk Taram - Gıda Bilim ve Teknoloji Dergisi
www.agrifoodscience.com
Türk Bilim ve Teknolojisi

Türkiye’de Üretilen Bazı Monofloral Bal Örneklerinin Biyokimyasal Özelliklerinin Belirlenmesi

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Bal standartları

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ÖZET

Bu çalışma, Türkiye genelinde üretilen 10 farklı monofloral bal çeşidinin biyokimyasal özelliklerini belirlemek amacıyla 2013 yılında yapılmıştır. Bu çalışma için bal örnekleri arıcılardan temin edilmiş, mikroskopik incelemeler ile bal örneklerindeki dominant polenler ve dominant polenlerin baldaki temsil oranları belirlenmiştir. Polen analizleri, Hayat (*Vitex agnus-castus*) ve ayçiçeği (*Helianthus annuus*) bal örneklerinin kendi bal örneklerini en yüksek oranda temsil etmişliği ortaya çıkarmıştır. Bu oran Hayat (*Vitex agnus-castus*) ve ayçiçeği (*Helianthus annuus*) bal örnekleri için %86 olarak belirlenirken en düşük polen miktarına sahip anason balı örnekleri için %45 olarak bulunmuştur. Biyokimyasal analizlerle, balın kalite özellikleri olan küllü 0,37±0,04, elektriksel iletkenlik 0,79±0,07 mS/cm, nem %19,15±0,09, pH 3,97±0,02, asitlik 29,07±0,39, meq/kg, Hidroksimetilfurfural (HMF) 6,17±0,76 mg/kg, dastaz 22,05±0,00, invert şeker %69,72±0,49 ve sakkaroz %2,90±0,30 olarak belirlenmiştir. Çalışmanın sonunda, bal örneklerinin biyokimyasal içeriklerinin, Türk Gıda Kodeksi Bal Tebliği, Avrupa Birliği Standartları ve Kodeks Standartlarına uygun olduğu belirlenmiştir.

Turkish Journal Of Agriculture - Food Science And Technology, 4(12): 1123-1126, 2016

The Determination of the Biochemical Properties of Some Monofloral Honey Samples Produced across Turkey

Saudi Journal of Biological Sciences 25 (2018) 1056–1065

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Original article

Antioxidant activities of some monofloral honey types produced across Turkey

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ABSTRACT

This study was conducted with the aim of determining the chemical, biochemical properties, and antimicrobial capabilities of some of the monofloral honeys produced in Turkey. In this study, 23 different monofloral honey samples were obtained from diverse geographical regions of Turkey. Floral origin of the honey samples was determined by melissopalynological analyses. Additionally, antioxidant properties were determined. To determine the antioxidant properties of honey samples, four test methods of total phenolic content, DPPH, iron reduction power and β-carotene linoleic acid emulsion method were used. As a result of the antioxidant activity analysis among the honey samples, rhododendron and parsley honey showed most prominent results in terms of the amount of phenolic compounds and antioxidant activity. On the other hand, acacia and citrus honey samples showed least antioxidant activity. A positive correlation was determined between four methods. Differences between antioxidant activities of honey samples were significantly found (P < 0.01).

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Macronutrient and micronutrient levels and phenolic compound characteristics of monofloral honey samples

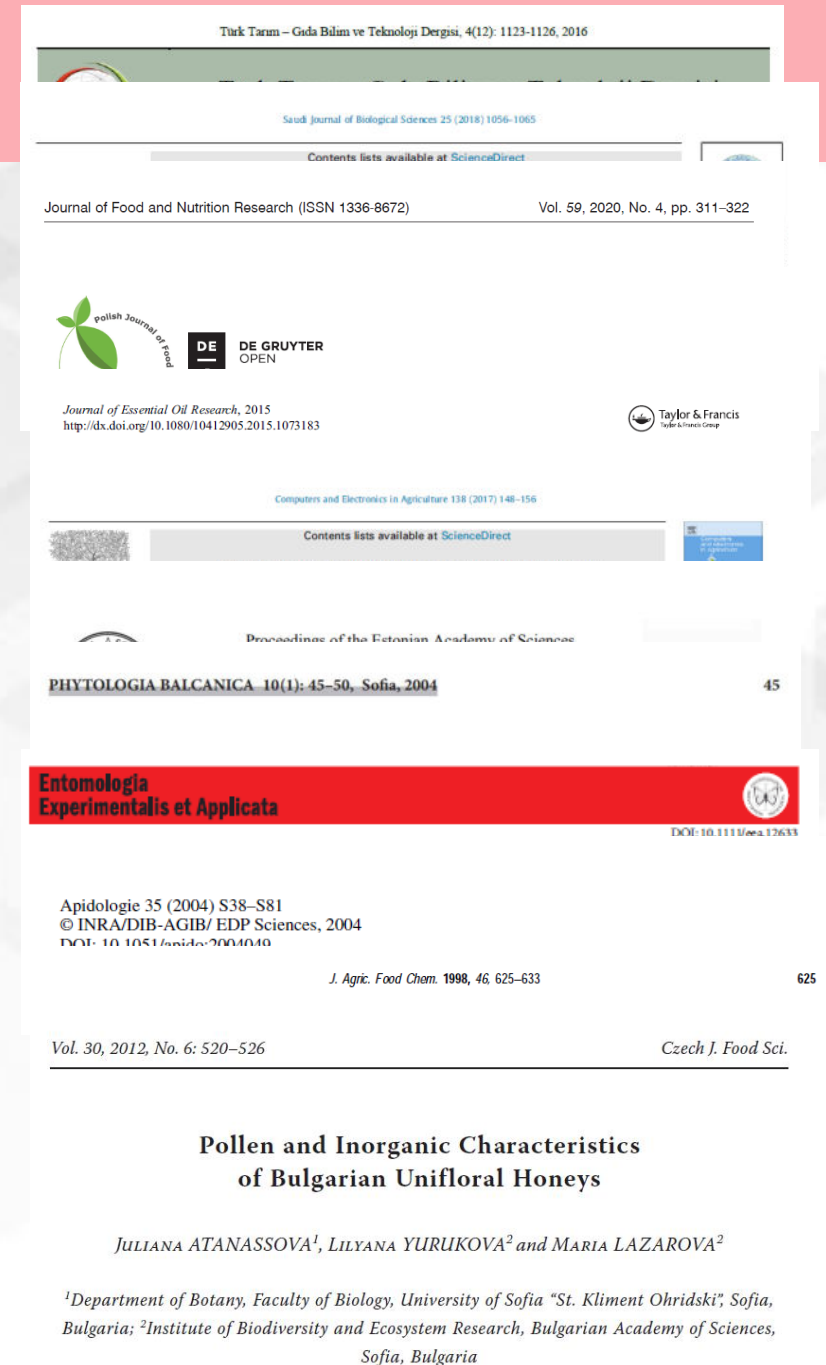
NESRİN ECEM BAYRAM – DENİZ CANLI – YUSUF CAN GERCEK – SINAN BAYRAM – SAFFET ÇELİK – FATMA GÜZEL – HANDE MORGİL – GÜL CEVAHİR OZ

Summary

This study aimed to obtain data on specific properties of various monofloral honey samples. Palynological, phenolic component, macroelemental and microelemental analyses were conducted and antimicrobial activities of honey samples were determined. In addition, protocatechuic acid for pine, lavender (from Isparta), heather (from Mugla) and cedar honey; gallic acid for carob, oak, lavender (from Antalya), chestnut, sandalwood and heather (from Antalya) honey; caffeic acid for linden, astragalus, chaste honey; syringic acid for rhododendron honey and the quercetin compound for cornelian cherry-citrus honey were observed to be dominant. As a result of the elemental analyses performed with inductively coupled plasma mass spectrometry, it was determined that elemental profiles of all of the honey samples differed, and the total ratio of macrominerals sodium, potassium, calcium, phosphorus and magnesium was the highest in the oak honey and the lowest in the cornelian cherry-citrus honey. According to antibacterial activity test results, Gram-negative bacteria were found to be more resistant to the honey samples compared to Gram-positive bacteria. In conclusion, the results of this study confirmed that the origin (blossom or honeydew) and plant source of the honey samples had an effect on their elemental content, phenolic component and antimicrobial activity.

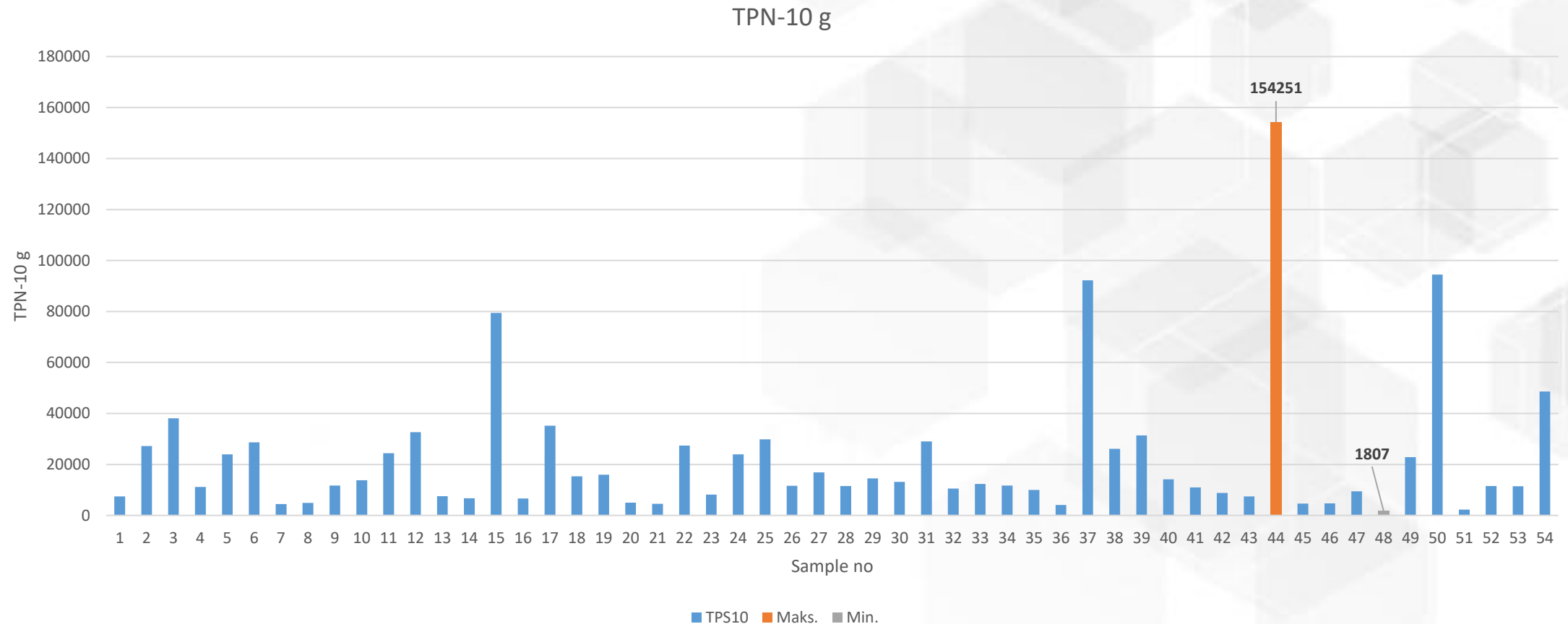
Melissopalynological Analysis

Tilia polen oranı	Ülke/Bölge	Referans
%66	Azdavay-Kastamonu/Türkiye	Gül, 2016; Pehlivan and Gül, 2015
%66	Ordu/Türkiye	Gül and Pehlivan, 2018
%27	Karabük/Türkiye	Ecem Bayram et al., 2020
%31,2-87,4	Romania	Oroian et al., 2015a
%63,5	Romania	Oroian et al., 2015b
%62,1-69,8	Romania	Oroian and Ropciuc, 2017
%79,0 - 53,9	Lithuanian	Čeksterytė et al., 2013
%77,5 - 71,8	Bulgaria	Atanassova and Kondova, 2004
%71,2	Serbia-Vojvodina	Orčić et al., 2017
%22,9 ±16,6	EU Countries	Persano Oddo and Piro, 2004
%5-23	France	Guyot et al., 1998
%36,8- 87,8	Bulgaria	Atanassova et al., 2012



Melissopalynological Analysis

Total Pollen Number - 10 g



MEAN= 22.173,65 ±27.023,69

It is observed that the TPN-10 g values of all honeys with dominant and secondary *Tilia* pollen are **below 15,000**.

Melissopalynological Analysis

Total Pollen Number - 10 g

TPN-10 g	Country/Region	Referans
18.102	Karabük/Türkiye	Ecem Bayram et al., 2020
9.870-13.460	Bulgaria	Atanassova and Kondova, 2004
15.800 ±9.600	EU Countries	Persano Oddo and Piro, 2004
<20.000	Italy	Persano Oddo et al., 1995
17.670	Bulgaria	Atanassova et al., 2012

MEAN= 22.173,65 ±27.023,69

Phsycochemical Analysis

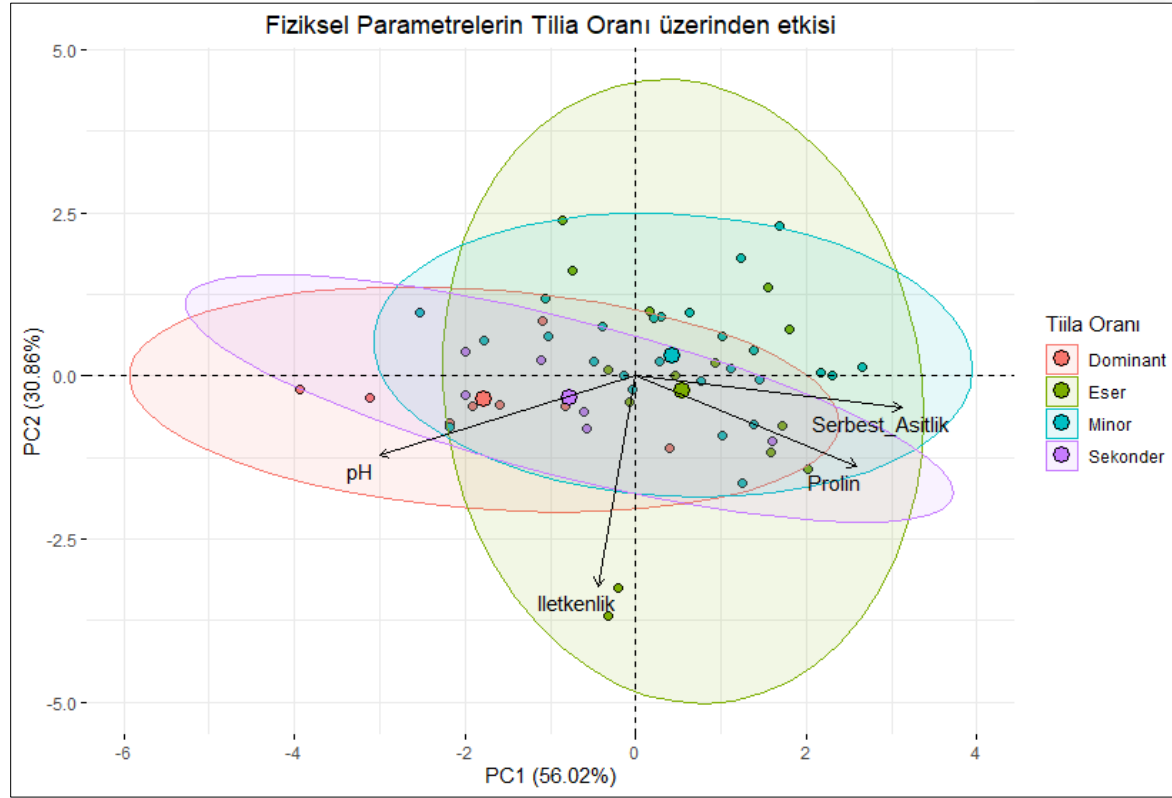
	Parameters	Min	Max	Mean
→	Proline	315.85 mg/kg	1072.49	665.955 ±210.527 mg/kg
→	Free acidity	13.3 meq/kg	65.50meq/kg	37.57 ±11.74 meq/kg
	G + F	53.65 g/100 g	77.74 g/100 g	68.45 ±4.90 g/100 g
	Sucrose	0,79 g/100 g	3,89 g/100 g	1.70 ±0.53 g/100 g
	Humidity	20.00%	14.60%	17.60 ±1.24%,
	Diastase	8.33	38.69	18.75 ±7.69
→	pH	3.54	4.86	4.08 ±0.25
→	Electrical conductivity	0.53	1.38	0.87 ±0.17 mS/cm
	HMF	1.60 mg/kg	12.66 mg/kg	4.41±2.02 mg/k

Elemental Analysis

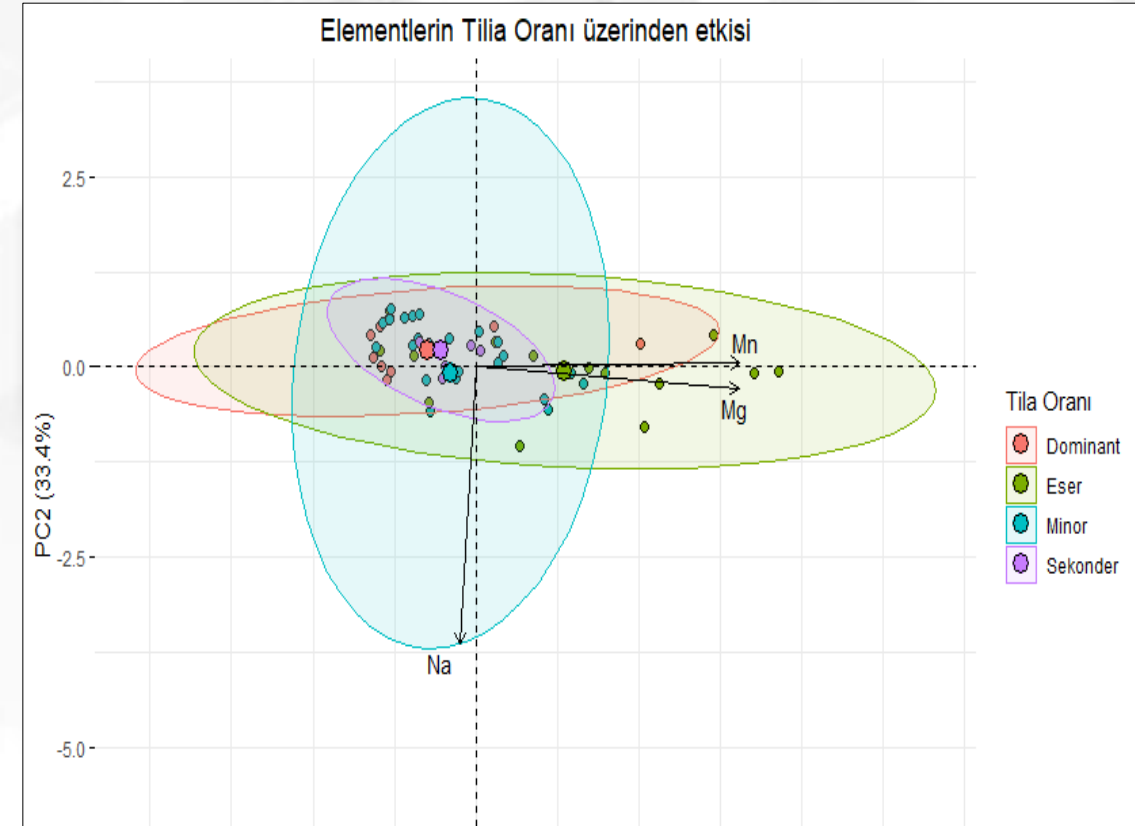
- The elements that were identified in the honey samples were

K> **Mg**> Na> Ca> Fe> Zn> **Mn**> Ni> Ba

Statistical Analysis - PCA



The **electrical conductivity, pH, proline, and free acidity** values could potentially be utilized as determining factors at a rate of **86.893%** in the differentiation of honeys according to *Tilia* pollen content.



Na, Mg, and Mn element quantities have been determined to account for **85.6%** of determining characters according to *Tilia* pollen content.

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Q&A...

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