



## Pollen Spectrum of Some Honey Samples Produced in Siirt-Turkey

### Siirt-Türkiye’de Üretilmiş Bazı Balların Polen Çeşitliliği

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#### ABSTRACT

Melissopalynology is the microscopic analysis of the pollen in the honey. This branch of palynology has been extensively used to determine the purity and quality of honey with its geographical and floral origins. The foraging plants of honeybees can be determined by analyzing the honey. In this study, the honeys originated from Siirt region were investigated. Totally 24 honey samples were evaluated with their total pollen numbers, moisture and pollen compositions. Total pollen numbers were ranged between 2086-55710, with the mean value of 22506. The pollen composition can be defined as relatively rich. It was found that 75% of the honeys were containing more than 10 plant taxa. Frequently observed plant families were Asteraceae, Fabaceae and Lamiaceae. According to these results we can claim that the examined regions of the city are really important for quality honey production.

#### Key Words

Honey, melissopalynology, pollen analysis, Siirt.

#### Öz

Baldaki polenin mikroskopik analizi melissopalinojisi olarak adlandırılmaktadır. Palinolojinin bu dalı, balın coğrafik kökenini, saflığını ve kalitesini belirlemek için yoğun şekilde kullanılmaktadır. Bal arılarının nektar ve polen topladıkları bitkiler, balın mikroskopik analizi ile belirlenebilmektedir. Bu çalışmada, Siirt bölgesinden toplanan ballar incelenmiştir. 24 bal örneğinin toplam polen sayısı, nem oranı ve polen bileşimleri değerlendirilmiştir. Toplam polen sayısı, 2086-55710 arasında değişmekte olup ortalama değeri 22506’dır. Analizi yapılan bal örneklerinin polen bileşimi, nispeten zengin olarak tanımlanmıştır. Balların %75’inin 10’dan fazla bitki taksonu içerdiği tespit edilmiştir. Bal örneklerinin mikroskopik analizi sonucu, sık gözlenen bitki aileleri Asteraceae, Fabaceae ve Lamiaceae olarak belirlenmiştir. Bu sonuçlara göre, kentin incelenen bölgelerinin zengin polen kaynaklı bal üretimi için önemli olduğunu iddia edebiliriz.

#### Anahtar Kelimeler

Bal, melissopalinojisi, polen analizi, Siirt.

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## INTRODUCTION

Turkey, is a large country with an area of 814.578 km<sup>2</sup> and serving as a bridge between Asia and Europe. It has 81 city and all of them have different type climate and rich flora because of three phytogeographic (Mediterranean, Europe-Siberia and Irano-Turanian) regions [1]. Euro-Siberian region is divided into two provinces. One is euxine and the second one is hyrcanian. The Euxine province is larger than hyrcanian province in Turkey and it extends throughout northern Turkey. It consists deciduous forest and conifers. Mediterranean region includes South Anatolia, West Anatolia and Gelibolu peninsula. Irano-Turanian region includes Inner Anatolia and East Anatolia. It divides into two major vegetational areas. One is forested area and the other one is steppe [1, 2].

There are about 12000 plant species with 3000 endemics in Turkey. Up to 500 plant species are nectary plants used by honey bees [3]. Turkey is the second country in the world after China, with presence of bee colonies (7.8 million bee colony) and annual honey production (114 thousand tons) [4, 5].

Siirt is one of the 81 provinces in Turkey and it is located in Southeast Anatolia of Turkey (Figure 1) and it is the one of the important point in terms of organic honey. Republic of Turkey Ministry of Agriculture and Forestry and Turkish Statistical Institute (TUIK) have been reported that there are 1793 beehives and 1878 kg of organic

honey production in Siirt region [6-9]. The terrestrial climate is dominant in the Siirt region and phytogeographical regions type is Irano-Turanian [10]. So generally steppe vegetation is common in this area [2].

In this study, the honeys originated from Siirt were investigated. Totally 24 honey samples were evaluated with their total pollen number and the pollen composition. Total pollen number in ten gram honey (TPN10) and plant diversity were found with melissopalynological analyses.

## MATERIALS and METHODS

### Collection of Samples

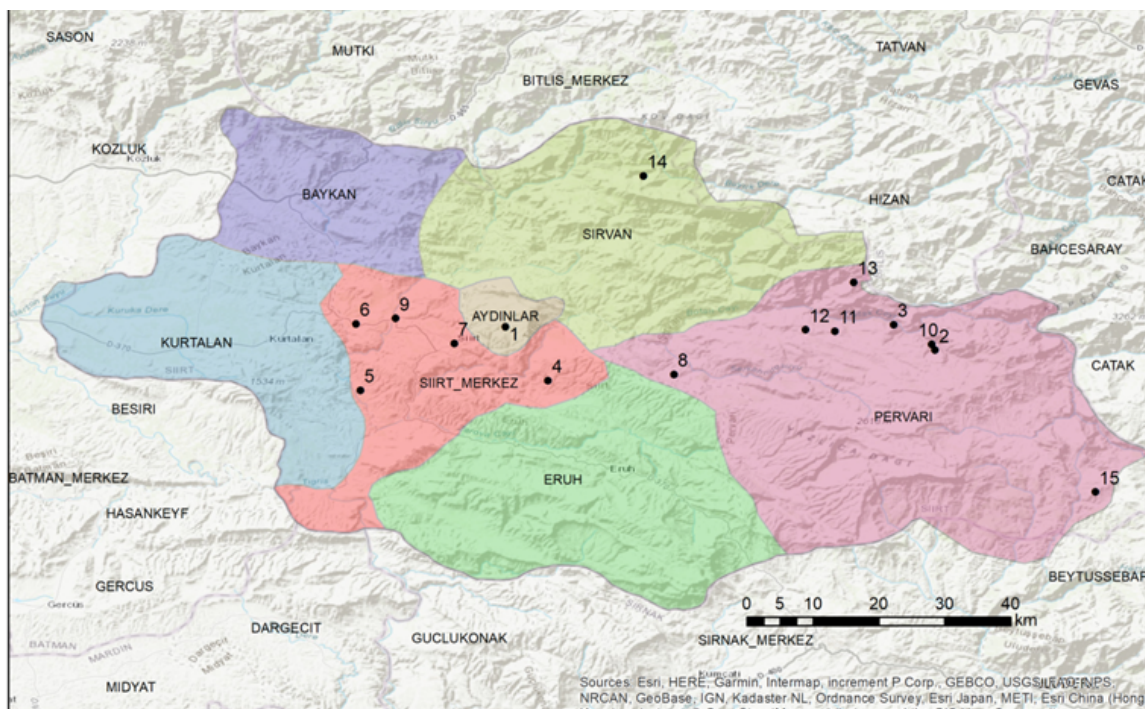
Total 24 honey samples were collected from Siirt region in 2018 (Figure 2). Honey samples were brought to Hacettepe University, Palynology and Bee Products Analysis Laboratory for melissopalynological analysis.

### Melissopalynological Analysis

The total number of pollen in honey gives information about honey quality. For this purpose, 10 grams of honey is weighed in a tube and distilled water is placed on it. Also one Lycopodium spore tablet, which is contain 9666 Lycopodium spores, is put in honey and water mix. This mix is heated until spore tablet melt and 10 drops liquid basic fuchsin added. After heating procedure mixture is centrifuged at 3500 rpm for 45 minutes. Then the top of the tube is poured and preparations are prepared from the bottom part with 50% glycerin water



**Figure 1.** Siirt region in Turkey (This map was created to work with the ArcGis 10.2) [11].



**Figure 2.** Siirt region in Turkey (This map was created to work with the ArcGis 10.2) [11].

mix. After that pollen and Lycopodium spore numbers are counted under microscope and calculated total pollen number (TPN10).

Beside total pollen number we determined plant diversity of the honey samples. For this purpose, 10 grams of honey is weighed in a tube and distilled water is placed on it. This mix is heated until honey melt. After that mixture is centrifuged at 3500 rpm for 45 minutes. Then the top of the tube is poured and preparations are prepared from the bottom part with glycerin gelatin mix. One hour later preparations can be examined. The materials were prepared for examination under the microscope according to the method of Louveaux, 1978 and Sorkun, 2008 [3, 12].

## RESULTS and DISCUSSION

Total 24 honey samples were investigated with mellissopalynological analysis in Siirt region. Total pollen number in ten gram honey (TPN10) was ranged between 2086-55710, with the mean value of 22506. Total pollen number between 20 thousand and 100 thousand honey is defined as good honey quality, between 100 thousand and 500 thousand is defined as rich honey quality [3, 13]. In our study we found 9 of the 24 honeys are bigger than 20.000 (Table 1). Beside this, plant

diversity is also important for determining honey origin. Pollen families are classified as dominant (D) ( $\geq 45\%$ ), secondary (S) (16-44%), minor (M) (3-15%), and trace (T) ( $<3\%$ ) in the honey [14]. If the pollen of the plant taxon represented in the honey is more than 45%, honey usually takes the name of that plant taxon [3, 15]. In this study *Onobrychis* spp., Fabaceae, *Salix* spp., *Centaurea* spp., *Carduus* spp., Lamiaceae, *Astragalus* spp., plant taxa's pollen number was found as dominant (sample numbers: 4, 6, 8, 10, 11, 12, 14, 23) (Table 1). So honey samples can named with these taxa names. On the other hand, pollen taxa amounts are seconder, minor and trace percentage in other honey samples and these honey types are called mixed flower honey (sample numbers: 1, 2, 3, 5, 7, 9, 13, 15, 16, 17, 18, 19, 20, 21, 22, 24) (Table 1).

Our study is the first study which is analyzed microscopic analysis of Siirt region honey samples. Erez (2015) studied also microscopic analysis of the Siirt honeys. But they only examined the honeys of the Pervari region, the town of Siirt [16]. They found Asteraceae, Apiaceae, Lamiaceae, Malvaceae, Rosaceae commonly in Pervari region. In our study we found similar families (Fabaceae, Asteraceae and Lamiaceae) commonly in Siirt region (Table 1).

**Table 1.** Siirt honey samples microscopic analysis results.

Sample No	Total Pollen Number (TPN)	Plant Profile in Honey	Pollen Percentage (%)*	Province	Family Number	Taxa Number
1	7837	Centaurea spp.	35.7 (S)	Siirt Pervari-Göl	4	7
		Fabaceae	21.4 (S)			
		Onobrychis spp.	14.2 (M)			
		Plantago spp.	7.1 (M)			
		Xanthium spp.	7.1 (M)			
		Poaceae	7.1 (M)			
		Asteracea	7.1 (M)			
2	44034	Carduus spp.	32.6 (S)	Siirt Pervari- Yukarıbalçılar	10	14
		Centaurea spp.	25 (S)			
		Fabaceae	11.5 (M)			
		Liliaceae	7.3 (M)			
		Onobrychis spp.	6.1 (M)			
		Brassicaceae	5 (M)			
		Apiaceae	4.6 (M)			
		Rosaceae	3 (M)			
		Poaceae	1.5 (T)			
		Plantago spp.	1.1 (T)			
		Taraxacum spp.	0.76 (T)			
		Cephalaria spp.	0.38 (T)			
		Lamiaceae	0.38 (T)			
Helianthus spp.	0.38 (T)					
3	34935	Trifolium spp.	29.7 (S)	Siirt Pervari- Yukarıbalçılar	12	16
		Apiaceae	21.7 (S)			
		Brassicaceae	13.1 (M)			
		Taraxacum spp.	8.5 (M)			
		Carduus spp.	5.7 (M)			
		Papaveraceae	4.5 (M)			
		Sanguisorba spp.	4 (M)			
		Lamiaceae	2.8 (T)			
		Salix spp.	2.8 (T)			
		Rosaceae	2.2 (T)			
		Scabiosa spp.	1.7 (T)			
		Echium spp.	0.5 (T)			
		Epilobium spp.	0.5 (T)			
		Thymus spp.	0.5 (T)			
		Onobrychis spp.	0.5 (T)			
Centaurea spp.	0.5 (T)					
4	5854	Onobrychis spp.	53.3 (D)	Siirt Pervari- Yukarıbalçılar	5	8
		Fabaceae	40 (S)			
		Lamiaceae	31.1 (S)			
		Thymus spp.	4.4 (M)			
		Centaurea spp.	4.4 (M)			
		Apiaceae	2.2 (T)			
		Hedysarum spp.	2.2 (T)			
		Rosaceae	2.2 (T)			
5	46873	Fabaceae	26 (S)	Siirt Pervari-Çavuşlu	8	10
		Liliaceae	19.1 (S)			
		Centaurea spp.	16.9 (S)			
		Carduus spp.	13.4 (M)			
		Plantago spp.	13 (M)			
		Berberidaceae	7.8 (M)			
		Brassicaceae	1.3 (T)			
		Apiaceae	0.86 (T)			
		Sanguisorba spp.	0.86 (T)			
		Taraxacum spp.	0.43 (T)			

**Table 1.** Siirt honey samples microscopic analysis results. Continue

Sample No	Total Pollen Number (TPN)	Plant Profile in Honey	Pollen Percentage (%)*	Province	Family Number	Taxa Number
6	19488	Fabaceae	46 (D)	Siirt Pervari-Güleçler	6	9
		Asteraceae	20 (S)			
		Carduus spp.	10.6 (M)			
		Taraxacum spp.	9.3 (M)			
		Apiaceae	4 (M)			
		Echinops spp.	3.3 (M)			
		Lamiaceae	3.3 (M)			
		Cucurbitaceae	2.6 (T)			
Geraniaceae	0.6 (T)					
7	14793	Fabaceae	40.2 (S)	Siirt Pervari-Sarıyaprak	10	11
		Asteraceae	34.7 (S)			
		Plantago spp.	7.6 (S)			
		Taraxacum spp.	5.4 (M)			
		Rumex spp.	3.2 (M)			
		Salix spp.	2.1 (T)			
		Berberidaceae	2.1 (T)			
		Apiaceae	1 (T)			
		Brassicaceae	1 (T)			
		Poaceae	1 (T)			
Rosaceae	1 (T)					
8	14881	Salix spp.	50 (D)	Siirt-Şirvan Kesmetaş	6	6
		Fabaceae	19.2 (S)			
		Apiaceae	11.5 (M)			
		Plantago spp.	11.5 (M)			
		Brassicaceae	3.8 (M)			
		Lamiaceae	3.8 (M)			
9	7072	Centaurea spp.	35.7 (S)	Siirt Pervari- Yukarıbalçılar	9	15
		Onobrychis spp.	11.2 (M)			
		Liliaceae	7.1 (M)			
		Rosaceae	7.1 (M)			
		Brassicaceae	7.1 (M)			
		Trifolium spp.	6.1 (M)			
		Hedysarum spp.	5.1 (M)			
		Carduus spp.	5.1 (M)			
		Plantago spp.	4 (M)			
		Taraxacum spp.	3 (M)			
		Apiaceae	2 (T)			
		Teucrium spp.	2 (T)			
		Fabaceae	2 (T)			
		Papaveraceae	1 (T)			
Lamiaceae	1 (T)					
10	9076	Centaurea spp.	53.7 (D)	Siirt Merkez	10	15
		Carduus spp.	9.43 (M)			
		Trifolium spp.	7.5 (M)			
		Brassicaceae	6.6 (M)			
		Onobrychis spp.	5.6 (M)			
		Papaveraceae	4.7 (M)			
		Taraxacum spp.	2.8 (T)			
		Rosaceae	1.8 (T)			
		Liliaceae	1.8 (T)			
		Fabaceae	0.9 (T)			
		Hedysarum spp.	0.9 (T)			
		Tilia spp.	0.9 (T)			
		Salix spp.	0.9 (T)			
		Plantago spp.	0.9 (T)			
		Teucrium spp.	0.9 (T)			

**Table 1.** Siirt honey samples microscopic analysis results. Continue

Sample No	Total Pollen Number (TPN)	Plant Profile in Honey	Pollen Percentage (%)*	Province	Family Number	Taxa Number
11	7444	Carduus spp.	48.6 (D)	Siirt Pervari-Merkez	13	15
		Trifolium spp.	20.8 (S)			
		Apiaceae	8.6 (M)			
		Campanula spp.	3.4 (M)			
		Centaurea spp.	2.6 (T)			
		Rosaceae	2.6 (T)			
		Lamiaceae	2.6 (T)			
		Chenopodiaceae	2.6 (T)			
		Geraniaceae	1.7 (T)			
		Sanguisorba spp.	1.7 (T)			
		Papaveraceae	0.8 (T)			
		Scabiosa spp.	0.8 (T)			
		Echium spp.	0.8 (T)			
		Asteraceae	0.8 (T)			
Plantago spp.	0.8 (T)					
12	3295	Lamiaceae	55.1 (D)	Siirt Merkez-Aktaş	6	9
		Trifolium spp.	10.3 (M)			
		Hedysarum spp.	10.3 (M)			
		Carduus spp.	6.8 (M)			
		Onobrychis spp.	3.4 (M)			
		Echium spp.	3.4 (M)			
		Salix spp.	3.4 (M)			
		Papaveraceae	3.4 (M)			
Centaurea spp.	3.4 (M)					
13	2086	Onobrychis spp.	34.2 (S)	Siirt Pervari-Tosuntarla	6	9
		Lamiaceae	31.4 (S)			
		Trifolium spp.	11.4 (M)			
		Centaurea spp.	8.5 (M)			
		Salix spp.	2.8 (T)			
		Carduus spp.	2.8 (T)			
		Hedysarum spp.	2.8 (T)			
		Cistaceae	2.8 (T)			
Apiaceae	2.8 (T)					
14	13808	Trifolium spp.	45 (D)	Siirt Merkez-Kışlacık	10	11
		Carduus spp.	30 (S)			
		Plantago spp.	7 (M)			
		Apiaceae	6 (M)			
		Lamiaceae	2 (T)			
		Poaceae	2 (T)			
		Taraxacum spp.	2 (T)			
		Papaveraceae	2 (T)			
		Rumex spp.	2 (T)			
		Sanguisorba spp.	1 (T)			
		Cistaceae	1 (T)			
15	55710	Astragalus spp.	36.4 (S)	Siirt Pervari	14	19
		Fabaceae	19.8 (S)			
		Rosaceae	6.6 (M)			
		Taraxacum spp.	3.9 (M)			
		Trifolium spp.	3.9 (M)			
		Lamiaceae	3.9 (M)			
		Carduus spp.	3.3 (M)			
		Liliaceae	3.3 (M)			
		Apiaceae	3.3 (M)			
		Tilia spp.	2.6 (T)			
		Campanula spp.	2.6 (T)			
		Plantago spp.	1.9 (T)			
		Centaurea spp.	1.9 (T)			
		Salix spp.	1.3 (T)			
		Cistaceae	1.3 (T)			
		Rumex spp.	1.3 (T)			
		Brassicaceae	0.6 (T)			
Poaceae	0.6 (T)					
Asteraceae	0.6 (T)					

**Table 1.** Siirt honey samples microscopic analysis results. Continue

Sample No	Total Pollen Number (TPN)	Plant Profile in Honey	Pollen Percentage (%)*	Province	Family Number	Taxa Number
16	34490	Carduus spp.	25.4 (S)	Siirt Pervari- Aşağıbalçılar	10	16
		Trifolium spp.	14.4 (M)			
		Onobrychis spp.	9.3 (M)			
		Rosaceae	9.3 (M)			
		Astragalus spp.	9.3 (M)			
		Trifolium pratense	6.7 (M)			
		Brassicaceae	5.9 (M)			
		Lamiaceae	5.9 (M)			
		Fabaceae	2.5 (T)			
		Salix spp.	2.5 (T)			
		Plantago spp.	2.5 (T)			
		Echium spp.	1.6 (T)			
		Centaurea spp.	1.6 (T)			
		Sanguisorba spp.	0.8 (T)			
Taraxacum spp.	0.8 (T)					
Scabiosa spp.	0.8 (T)					
17	44967	Carduus spp.	17.6 (S)	Siirt Pervari-Güleçler	10	13
		Liliaceae	16.4 (S)			
		Plantago spp.	12.9 (M)			
		Berberidaceae	10.5 (M)			
		Brassicaceae	9.4 (M)			
		Lamiaceae	9.4 (M)			
		Trifolium spp.	8.2 (M)			
		Centaurea spp.	7 (M)			
		Astragalus spp.	3.5 (M)			
		Taraxacum spp.	1.17 (T)			
		Geraniaceae	1.17 (T)			
		Rumex spp.	1.17 (T)			
Cephalaria spp.	1.17 (T)					
18	9502	Carduus spp.	22.2 (S)	Siirt Merkez-Köprübaşı	11	13
		Trifolium spp.	14.2 (M)			
		Cistaceae	12.6 (M)			
		Trifolium pratense	9.5 (M)			
		Brassicaceae	7.9 (M)			
		Salix spp.	7.9 (M)			
		Apiaceae	6.3 (M)			
		Tilia spp.	4.7 (M)			
		Poaceae	4.7 (M)			
		Plantago spp.	3.1 (M)			
		Lamiaceae	3.1 (M)			
		Taraxacum spp.	1.5 (T)			
Liliaceae	1.5 (T)					
19	12082	Salix spp.	24.4 (S)	Siirt Merkez-Bayraktepe	11	13
		Cistaceae	12.2 (M)			
		Trifolium pratense	10.2 (M)			
		Brassicaceae	10.2 (M)			
		Apiaceae	8.1 (M)			
		Trifolium spp.	6.1 (M)			
		Tilia spp.	6.1 (M)			
		Carduus spp.	6.1 (M)			
		Sanguisorba spp.	4 (M)			
		Poaceae	4 (M)			
		Lamiaceae	4 (M)			
		Rumex spp.	2 (T)			
Taraxacum spp.	2 (T)					

**Table 1.** Siirt honey samples microscopic analysis results. Continue

Sample No	Total Pollen Number (TPN)	Plant Profile in Honey	Pollen Percentage (%)*	Province	Family Number	Taxa Number
20	17249	Centaurea spp.	31.7 (S)	Siirt Merkez-Bayraktepe	13	15
		Carduus spp.	22.2 (S)			
		Taraxacum spp.	12.6 (M)			
		Rosaceae	6.3 (M)			
		Brassicaceae	6.3 (M)			
		Liliaceae	5.5 (M)			
		Plantago spp.	3.9 (M)			
		Apiaceae	3.1 (M)			
		Salix spp.	3 (M)			
		Onobrychis spp.	1.6 (T)			
		Papaveraceae	0.8 (T)			
		Cephalaria spp.	0.8 (T)			
		Lamiaceae	0.8 (T)			
		Sanguisorba spp.	0.8 (T)			
Convolvulus spp.	0.8 (T)					
21	19596	Trifolium spp.	41 (S)	Siirt Pervari-Güleçler	9	13
		Carduus spp.	28 (S)			
		Astragalus spp.	7 (M)			
		Plantago spp.	6 (M)			
		Centaurea spp.	5 (M)			
		Lamiaceae	3 (M)			
		Cistaceae	3 (M)			
		Apiaceae	2 (T)			
		Geraniaceae	1 (T)			
		Papaveraceae	1 (T)			
		Taraxacum spp.	1 (T)			
Onobrychis spp.	1 (T)					
Rosaceae	1 (T)					
22	36169	Trifolium pratense	17.2 (S)	Siirt Pervari-Kopik	13	17
		Apiaceae	13.2 (M)			
		Taraxacum spp.	11.9 (M)			
		Papaveraceae	11.9 (M)			
		Cistaceae	11.2 (M)			
		Brassicaceae	9.9 (M)			
		Lamiaceae	7.2 (M)			
		Carduus spp.	5.2 (M)			
		Astragalus spp.	3.3 (M)			
		Salix spp.	1.9 (T)			
		Rosaceae	1.3 (T)			
		Centaurea spp.	1.3 (T)			
		Scabiosa spp.	1.3 (T)			
		Poaceae	0.66 (T)			
Sanguisorba spp.	0.66 (T)					
Onobrychis spp.	0.66 (T)					
Malvaceae	0.66 (T)					
23	26302	Astragalus spp.	57.3 (D)	Siirt Pervari- Yukarıbalçılar	10	12
		Apiaceae	9.8 (M)			
		Trifolium spp.	8.2 (M)			
		Lamiaceae	8.2 (M)			
		Plantago spp.	4.9 (M)			
		Trifolium pratense	1.6 (T)			
		Rosaceae	1.6 (T)			
		Tilia spp.	1.6 (T)			
		Salix spp.	1.6 (T)			
		Brassicaceae	1.6 (T)			
		Poaceae	1.6 (T)			
Campanula spp.	1.6 (T)					



**Table 1.** Siirt honey samples microscopic analysis results. Continue

Sample No	Total Pollen Number (TPN)	Plant Profile in Honey	Pollen Percentage (%)*	Province	Family Number	Taxa Number
24	52601	Astragalus spp.	40 (S)	Siirt Pervari- Yukarıbalçılar	14	17
		Apiaceae	16.8 (S)			
		Rosaceae	6.4 (M)			
		Trifolium pratense	5.6 (M)			
		Plantago spp.	4 (M)			
		Liliaceae	3.2 (M)			
		Brassicaceae	3.2 (M)			
		Cistaceae	3.2 (M)			
		Campanula spp.	3.2 (M)			
		Taraxacum spp.	2.4 (T)			
		Carduus spp.	2.4 (T)			
		Tilia spp.	2.4 (T)			
		Lamiaceae	2.4 (T)			
		Caryophyllaceae	1.6 (T)			
		Papaveraceae	1.6 (T)			
Cephalaria spp.	0.8 (T)					
Scabiosa spp.	0.8 (T)					

\* ≥%45 Dominant (D), (%16-44) Seconder (S), (%3-15) Minor (M), (<%3) Trace (T).

The pollen composition can be defined as relatively rich. It was found that 75% of the honeys were containing more than 10 plant taxa. It was found that dominantly observed plant taxa were *Onobrychis* spp., *Fabaceae*, *Salix* spp., *Centaurea* spp., *Carduus* spp., *Lamiaceae*, *Astragalus* spp. According to these results, we can claim that the examined regions of the city are important honey production areas. It should be emphasized that these plants are important for apiculture in the region and care should be taken not to use them as grassland in flowering periods.

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