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Airborne Pollen Grains in Savastepe (Balıkesir)

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Özet

Bu çalışmada, 2002 yılında Savastepe (Balıkesir) atmosferindeki polen konsantrasyonları gravimetrik yöntem kullanılarak izlenmiştir. 28 takson ve tanımlanamayan polenler kaydedilmiştir. Bu taksonlardan 17'si odunsu bitkilere (AP), 11'i otsu bitkilere (NAP) aittir. Örneklemede cm^2 'de toplam 4750 polen sayılmış olup bunların 4163'ü odunsu bitkilere (%87,64), 542'si otsu bitkilere (%11,41) ve 45'i (%0,95) tanımlanamayan polenlere aittir. Dominant taksonlar: *Pinus* spp. (%58,20), *Cupressaceae/Taxaceae* (%21,33), *Gramineae* (%8,19), *Quercus* spp. (%1,59), *Olea* spp. (%1,31), *Fraxinus* spp. (%1,26) ve *Abies* spp. (%1,06)'dir. Çalışma süresi boyunca polen konsantrasyonu en üst seviyesine Nisan ayında ulaşmıştır.

Anahtar Kelimeler: *Polen, polen takvimi, Savastepe, Türkiye.*

Identification of Airborne Pollen Grains in Savastepe (Balıkesir)

Abstract

In this study, pollen concentrations were monitored in the atmosphere of Savastepe (Balıkesir) during 2002 by using gravimetric method. 28 taxa and unidentified pollen grains were recorded. From these taxa, 17 of them belong to arboreal plants (AP), 11 to non arboreal plants (NAP). A total of 4750 pollen grains/ cm^2 counted in the sampling, of these 4163 pollen/ cm^2 pertain to arboreal plants (87.64%), 542 pollen/ cm^2 to non arboreal plants (11.41%) and 45 pollen/ cm^2 (0.95%) to unidentified. Dominating taxa were: *Pinus* spp. (58.20%), *Cupressaceae/Taxaceae* (21.33%), *Gramineae* (8.19%), *Quercus* spp. (1.59%), *Olea* spp. (1.31%), *Fraxinus* spp. (1.26%) and *Abies* spp. (1.06%). During the study period, the pollen concentration reached its highest level in April.

Keywords: *Pollen, pollen calendar, Savastepe, Turkey.*

INTRODUCTION

Pollen allergy is a common disease caused by a hipertensivity allergic reaction of the respiratory system and the eye conjunctivae to pollen grains. During the pollination season sensitive individuals shows the symptoms like; allergic rhinitis, allergic conjunctivitis, allergic bronchial asthma and urticaria. Determination of pollen type and concentrations of pollen grains will be useful for patients' complaining from pollen allergy. For this reason, pollen calendars have been prepared in many countries in the world (Giner et al. 2002, Abreu et al. 2003, Ballero and Maxia 2003, Peternel et al. 2003, Gioulekas et al. 2004, Weryszko-Chmielewska and Piotrowska 2004).

Also in Turkey, airborne pollen grains of many cities; Istanbul (Aytug 1973), Samsun (Yurdokuru 1979), Serik (Antalya) (Ince and Pehlivan 1990), Aksaray (Pehlivan and Butev 1994), Ankara

(Inceoglu et al. 1994), Kırıkkale (Ince 1994), Ankara (Beytepe) (Dogan and Erik 1995), Sivas (Pehlivan and Ozler 1995), Balıkesir (Bicakci and Akyalcin 2000a), Burdur (Bicakci et al. 2000b), Isparta (Bicakci et al. 2000c), Afyon (Bicakci et al. 2002a), Buca (Izmir) (Guvensen and Ozturk 2002), Bursa (Bicakci et al. 2003), Izmir (Guvensen and Ozturk 2003), Adana (Altintas et al. 2004), Bartın (Kaya and Aras 2004), Edirne (Bicakci et al. 2004a), Kayseri (Ince et al. 2004), Zonguldak (Kaplan 2004), Bitlis (Celenk and Bicakci 2005), Bozuyuk (Bilecik) (Ture and Salkurt 2005), Canakkale (Guvensen et al. 2005), Denizli (Celik et al. 2005), Sakarya (Bicakci et al. 2006) were determined.

The aims of the study were; to expose the pollen types present in the atmosphere, their actual conditions and to establish the pollen calendar for Savastepe.

MATERIALS AND METHODS

Study Area

Savastepe is situated in the North-west of Turkey (39° 19' 48" N, 27° 39' 32" E) between Marmara and Aegean geographical regions and altitude varies between 280-300 meters. Study area has Mediterranean climate in general and typical maquis elements can be seen in. On the slopes of the mountains and hillsides which surround the area, oak woods and pine forests are dominate. In addition, *Olea europea* L., *Juglans regia* L., *Platanus orientalis* L., *Pinus pinea* L., *Pinus nigra* Arn., *Pinus brutia* Ten., *Cupressus sempervirens* L. *Populus* spp. and *Acer* spp. are frequently seen in the parks. Also in the agricultural region; cotton, wheat, beetroot, vegetables and orchards; figs, vineyards, apples, quinces, morellos, peaches are cultivating.

Pollen Trapping and Identification

From 1 January to 31 December 2002, a Durham gravimetric pollen trap located at the top of the structure, where is 15 m above the ground level. Weekly slides were covered with glycerin jelly mixed with basic fuchsin (Charpin and Surinyach 1974). For identification of pollen grains binocular light microscope was used and counting was done on 22x22 mm (4.84 cm²) area of the slide, which was calculated to 1 cm². Weekly pollen concentration of plant taxa were recorded, weekly pollen calendar was prepared (Fig. 2).

RESULTS

In the study, 4750 pollen/cm² from 28 taxa were identified in the atmosphere of Savastepe. Of these, 17 taxa were arboreal and the others non-arboreal plants. 4163 pollen/cm² found to be arboreal (87.64%), 542 pollen/cm² as non-arboreal (11.41%) and 45 pollen/cm² as unidentified (0.95%) (Table 1).

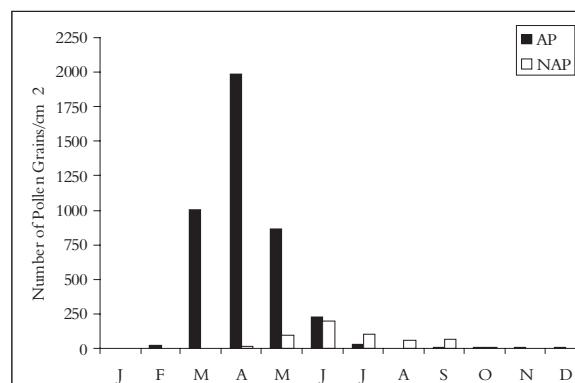
The main producers were such as *Pinus* spp., Cupressaceae/Taxaceae, Gramineae, *Quercus* spp., *Olea* spp., *Fraxinus* spp. and *Abies* spp. were found most frequently and they formed 92.95% of the total in Savastepe atmosphere (Table 1).

Monthly means of total pollen grains recorded in the atmosphere are shown in Fig. 1. In the sampling period, the highest concentration was in April with 42.18% of total pollen grains and there were not any pollen grains were found in the atmosphere in January (Fig. 1, Table 2). During the February, March, April, May, June, November and December; pollen grains of arboreal plants dominated and during July, August and September; non arboreal

Table 1. Pollen taxa found in the atmosphere of Savastepe in the year 2002.

Taxa	Pollen/cm ²	%
<i>Pinus</i> spp.	2764	58.20
Cupressaceae/Taxaceae	1013	21.33
<i>Quercus</i> spp.	76	1.59
<i>Olea</i> spp.	62	1.31
<i>Fraxinus</i> spp.	60	1.26
<i>Abies</i> spp.	50	1.06
<i>Platanus</i> spp.	33	0.70
<i>Fagus</i> spp.	21	0.44
<i>Alnus</i> spp.	12	0.25
Ericaceae	12	0.25
<i>Pistacia</i> spp.	11	0.24
<i>Ulmus</i> spp.	11	0.22
<i>Acer</i> spp.	8	0.17
<i>Juglans</i> spp.	8	0.17
Oleaceae	8	0.17
<i>Populus</i> spp.	7	0.14
Rosaceae	6	0.13
Arboreal Plants	4163	87.64
Gramineae	389	8.19
<i>Xanthium</i> spp.	31	0.65
Amarathaceae/Chenopodiaceae	30	0.64
<i>Plantago</i> spp.	17	0.36
Caryophyllaceae	15	0.32
Leguminosae	12	0.25
Umbelliferae	12	0.24
Compositae	11	0.23
Urticaceae	10	0.22
<i>Taraxacum</i> spp.	9	0.18
Labiatae	6	0.13
Non arboreal Plants	542	11.41
Unidentified	45	0.95
Total	4750	100.00

Fig 1. Monthly variation in the percentage of arboreal (AP) and non-arboreal pollen (NAP) grains in Savastepe.



ones, no arboreal pollen were counted in the first month of the year and in January, February, March, November and December non-arboreal pollen grains haven't been shown in Savastepe atmosphere (Fig. 1).

The earliest airborne pollen grains recorded in February from the following species and the percentages; Cupressaceae/Taxaceae (0.29%), *Pinus* spp. (0.14%), *Fraxinus* spp. (0.07%), *Alnus* spp.

(0.04%). 26 pollen/cm² counted in February (0.54% of total pollen concentration) (Table 2). Pollen grains recorded in Savastepe atmosphere in March were; Cupressaceae/Taxaceae (13.48%), *Pinus* spp. (6.29%), *Fraxinus* spp. (0.97%), *Alnus* spp. (0.17%), Oleaceae (0.11%), *Ulmus* spp. (0.10%), *Acer* spp. (0.06%), *Populus* spp. (0.06%). Second highest pollen concentration was in this month; 1010 pollen/cm² were counted and that was 21.26% of the total pollen concentration in the year (Table 2). In the sampling period the highest concentration was in April, number of pollen grains increased and most founded pollen grains in this month were; *Pinus* spp. (34.46%) and Cupressaceae/Taxaceae (5.78%), *Quercus* spp. (0.36%), *Fagus* spp. (0.23%), *Fraxinus* spp. (0.23%), *Abies* spp. (0.19%), *Ulmus* spp. (0.13%), *Platanus* spp. (0.12%), Gramineae (0.10%), *Populus* spp. (0.08%), Oleaceae (0.06%), Compositae (0.06%), Leguminosae (0.06%), *Acer* spp. (0.04%), *Alnus* spp. (0.04%), *Juglans* spp. (0.04%), Amaranthaceae/Chenopodiaceae (0.04%), Umbelliferae (0.04%), Urticaceae (0.02%). 2004 pollen/cm² were recorded and that was 42.18% of the total pollen concentration (Table 2). In May, pollen grains that originating from *Pinus* spp. (13.71%), Gramineae (1.59%), Cupressaceae /Taxaceae (1.56%), *Quercus* spp. (1.23%) were dominate. 971 pollen/cm² counted in this month (20.44% of total pollen concentration) (Table 2). Dominating pollen grains and their percentages in June were; Gramineae (3.64%), *Pinus* spp. (3.31%), *Olea* spp. (1.06%). 435 pollen grains per cm² was recorded and in this month and this number is calculated as 9.16% of total pollen concentration in 2002 (Table 2). 139 pollen/cm² were counted in July and that was 2.92% of the total pollen concentration in the year. Pollen grains belonging to dominating plant taxa were from Gramineae family (1.45%). Dominating pollen grains were Gramineae (0.74%) and Amaranthaceae/Chenopodiaceae (0.28%) in August. 64 pollen grains were counted per cm² in this month and it was 1.35% of total pollen content (Table 2). In September, 83 pollen/cm² were counted and that was 1.74% of the total pollen concentration in the year. Recorded plant taxa and their percentages were; Gramineae (0.67%), *Xanthium* spp. (0.58%), Ericaceae (0.06%), *Taraxacum* spp. (0.06%), Rosaceae (0.04%), Leguminosae (0.04%), *Plantago* spp. (0.04%), Amaranthaceae/Chenopodiaceae (0.02%) (Table 2). 12 pollen grains/cm² counted in October,

Table 2. Monthly variation of airborne pollen grains in Savastepe atmosphere in 2002.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
<i>Abies</i> spp.	-	-	-	0.19	0.78	0.07	0.02	-	-	-	-	-	1.06
<i>Acer</i> spp.	-	-	0.06	0.04	0.06	-	-	-	-	-	-	-	0.17
<i>Alnus</i> spp.	-	0.04	0.17	0.04	-	-	-	-	-	-	-	-	0.25
Cupressaceae/Taxaceae	-	0.29	13.48	5.78	1.56	0.15	0.06	-	-	-	-	-	21.33
Ericaceae	-	-	-	-	-	-	0.04	0.02	0.06	0.04	0.06	0.02	0.25
<i>Fagus</i> spp.	-	-	-	0.23	0.19	0.02	-	-	-	-	-	-	0.44
<i>Fraxinus</i> spp.	-	0.07	0.97	0.23	-	-	-	-	-	-	-	-	1.26
<i>Juglans</i> spp.	-	-	-	0.04	0.13	-	-	-	-	-	-	-	0.17
<i>Olea</i> spp.	-	-	-	-	1.06	0.25	-	-	-	-	-	-	1.31
Oleaceae	-	-	0.11	0.06	-	-	-	-	-	-	-	-	0.17
<i>Pinus</i> spp.	-	0.14	6.29	34.46	13.71	3.31	0.28	-	-	-	-	-	58.20
<i>Pistacia</i> spp.	-	-	-	-	0.06	0.18	-	-	-	-	-	-	0.24
<i>Platanus</i> spp.	-	-	-	0.12	0.56	0.02	-	-	-	-	-	-	0.70
<i>Populus</i> spp.	-	-	0.06	0.08	-	-	-	-	-	-	-	-	0.14
<i>Quercus</i> spp.	-	-	-	0.36	1.23	-	-	-	-	-	-	-	1.59
Rosaceae	-	-	-	-	0.02	0.02	0.02	-	0.04	0.02	-	-	0.13
<i>Ulmus</i> spp.	-	-	0.10	0.13	-	-	-	-	-	-	-	-	0.22
Arboreal Plants	-	0.54	21.24	41.77	18.31	4.82	0.68	0.02	0.11	0.06	0.06	0.02	87.64
Gramineae	-	-	-	0.10	1.59	3.64	1.45	0.74	0.67	-	-	-	8.19
Amar./Chenopodiaceae	-	-	-	0.04	0.08	0.12	0.09	0.28	0.02	-	-	-	0.64
Caryophyllaceae	-	-	-	-	0.07	0.23	0.02	-	-	-	-	-	0.32
Compositae	-	-	-	0.06	0.04	0.04	0.06	0.02	-	-	-	-	0.23
Labiatae	-	-	-	-	-	0.06	0.06	-	-	-	-	-	0.13
Leguminosae	-	-	-	0.06	0.03	0.08	0.02	0.02	0.04	-	-	-	0.25
<i>Plantago</i> spp.	-	-	-	-	0.08	0.04	0.10	0.10	0.04	-	-	-	0.36
<i>Taraxacum</i> spp.	-	-	-	-	0.04	0.04	0.02	-	0.06	0.02	-	-	0.18
Umbelliferae	-	-	-	0.04	0.06	0.06	0.07	-	-	-	-	-	0.24
Urticaceae	-	-	-	0.02	0.09	0.06	0.04	-	-	-	-	-	0.22
<i>Xanthium</i> spp.	-	-	-	-	-	-	-	0.02	0.58	0.04	-	-	0.65
Non arboreal Plants	-	-	-	0.33	2.02	4.16	2.15	1.26	1.42	0.06	-	-	11.41
Unidentified	-	-	0.02	0.08	0.11	0.17	0.08	0.06	0.21	0.13	0.06	0.02	0.95
Total	-	0.54	21.26	42.18	20.44	9.16	2.92	1.35	1.74	0.25	0.13	0.04	100.00

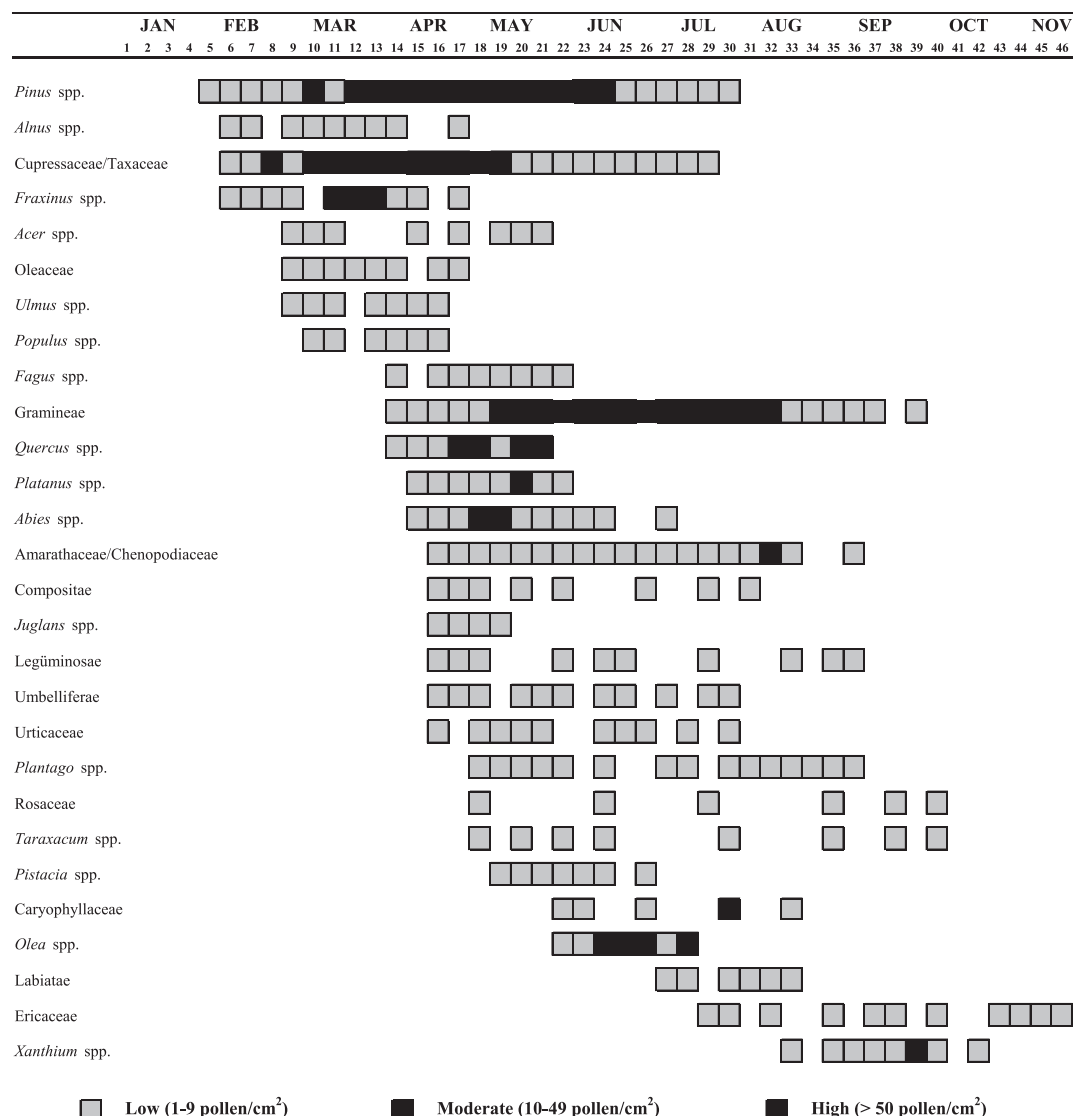
and this number calculated as 0.25% of total pollen grains recorded in whole year. Pollen types which recorded in October only belongs to Ericaceae (0.04%), *Xanthium* spp. (0.04%), Rosaceae (0.02%) and *Taraxacum* spp. (0.02%) (Table 2). In November and December, recorded pollen grains only belongs to Ericaceae family with the percentages of 0.06 and 0.02 (Table 2).

DISCUSSION

In our study, there was an increase in number of pollen grains from February to April (Fig. 1), we conclude that was a result of pollination season of arboreal plant taxa which produce a great deal of pollen grains, such as *Pinus* spp. Cupressaceae/Taxaceae, *Fraxinus* spp., *Alnus* spp., *Acer* spp., Oleaceae, *Ulmus* spp. and *Populus* spp.. Number of pollen grains in the atmosphere of Savastepe reached their highest level in April especially with the *Pinus* spp. (34.46%) and the Cupressaceae/Taxaceae (5.78%) pollen grains' great contribution (Table 2).

Airborne pollen grains of arboreal plants were found to predominate in the atmosphere of Savastepe in 2002 with 87.64% (Table 2). That was due to the vegetation, climate and geographical location of Savastepe. Arboreal pollen types also found as dominant in Finland (82%) (Koivikko et al.

Fig. 2. Annual pollen calendar of Savastepe in 2002.



1986), Ascoli Piceno, Italy (55%) (Romano et al. 1988); Ostrawiec Swietokrzyski, Poland (73%) (Kasprzyk 1996); Balikesir, Turkey (70.92%) (Bicakci et al. 2000a); Usak, Turkey (79.12%) (Bicakci et al. 2004b) and Sakarya, Turkey (69.45%) (Bicakci 2006). Pollen grains belonging to *Pinus* spp. were founded as the most frequent ones and they constituted 58.20% of the total in the atmosphere of Savastepe (Table 2). Pollination season of this taxon takes nearly six months in Savastepe. They reached their highest level in April with the percentage of 34.46%. *Pinus* pollen grains reported as a dominant also in Afyon (26.27%) (Bicakci et al. 2002a), Bursa (20.87%) (Bicakci et al. 2003), and Lublin-Poland (15.05%) (Weryszko-Chmielewska and Piotrowska

2004).

Pollen grains belong to Gramineae family was the most frequent ones among to non arboreal plants. They have a quite long pollination season and seen in the atmosphere of Savastepe from April to September (Fig 2). Percentage was 8.19 of the total and according to other studies which prepared in different cities, Gramineae were the most frequent pollen grain among to non arboreal plants such as; Santiago, Chile (7.6%) (Villegas and Nolla 2001), Brisbane (71.6%) (Green et al. 2002), Izmir (7.7-6%) (Guvensen and Ozturk 2003), Bitlis (25.19%) (Celenk and Bicakci 2005) and Sakarya (18.95%) (Bicakci 2006).

Arboreal pollen grains such as *Pinus* spp.,

Cupressaceae/Taxaceae, *Quercus* spp., *Olea* spp., *Fraxinus* spp. and *Abies* spp. and non-arboreal pollen grains belongs to Gramineae, occupy a place, which encountered to have more than 1% of the total pollen content. Most of dominating pollen grains in Savastepe atmosphere which listed above are reported as important allergens. However, pollen grains belong to Pinaceae family is not too risky for sensitive individuals because allergenic effect of them is not too considerable (Levetin and Buck 1980, Harris and German 1985, Fang et al. 2001). We recorded high levels of important allergenic pollen grains such as Cupressaceae/Taxaceae (Nardi et al. 1996), *Quercus* spp. (Levetin and Buck 1980), *Olea* spp. and *Fraxinus* spp. (D'Amato 1998). Also grass pollen is the major cause of pollinosis in many parts of the world and grass-induced pollinosis is the most common pollen allergy also in the Mediterranean area (D'Amato and Lobefalo 1989, D'Amato and Liccardi 1994)

According to other studies in the world; *Platanus* spp., Poaceae, *Acer* spp., *Cupressus* spp., Chenopodiaceae, Urticaceae, *Morus* spp., *Plantago* spp. and Oleaceae in Santiago, Chile (Villegas and Nolla 2001); *Betula* spp., *Corylus* spp., *Ambrosia* spp., Urticaceae in Zagreb, Croatia (Peternel et al. 2002); Cupressaceae, Pinaceae, Urticaceae, Anacardiaceae, Oleaceae and Polygonaceae in Cagliari, Italy (Ballero and Maxia 2003); *Taxus*/Cupressaceae, *Quercus* spp., Poaceae, *Pinus* spp., *Betula* spp., Urticaceae and *Fraxinus* spp. in Neuchâtel, Switzerland (Clot 2003); Cupressaceae, Gramineae, Hamamelidaceae, Pinaceae, Urticaceae, *Quercus* spp., *Acer* spp., Myrtaceae, Caryophyllaceae, Oleaceae, Betulaceae and *Plantago* spp. in Porto region, Portugal (Abreu et al. 2003); *Morus* spp., *Cannabis* spp., Poaceae, Chenopodiaceae/

Amaranthaceae, *Prosopis* spp., *Artemisia* spp., *Eucalyptus* spp., *Ricinus* spp., *Parthenium* spp., *Xanthium* spp. in Delhi, India (Singh et al. 2003); Cupressaceae, *Quercus* spp., Urticaceae, Oleaceae, Pinaceae, Poaceae, Platanaceae, *Corylus* spp., Chenopodiaceae and *Populus* spp. in Thessaloniki, Greece (Gioulekas et al. 2004); *Betula* spp., Pinaceae, *Alnus* spp., Poaceae and *Urtica* spp. in Lublin, Poland (Weryszko-Chmielewska and Piotrowska 2004) were dominate. In Turkey; *Pinus* spp., *Olea* spp., *Platanus* spp., Gramineae, Cupressaceae/Taxaceae, *Quercus* spp., *Acer* spp., *Morus* spp., *Xanthium* spp., *Castanea* spp., Chenopodiaceae/Amaranthaceae, *Corylus* spp., *Artemisia* spp., *Urtica* spp. and *Fraxinus* spp. were dominate in Bursa (Bicakci et al. 2003); Gramineae, Urticaceae, *Juglans* spp., *Quercus* spp., Umbelliferae, Cupressaceae/Taxaceae, *Fraxinus* spp., *Salix* spp., *Plantago* spp., *Pinus* spp., *Rumex* spp., Moraceae and Chenopodiaceae/Amaranthaceae were dominating plant taxa in Bitlis (Celenk and Bicakci 2005) and *Pinus* spp., *Quercus* spp., Cupressaceae/Taxaceae, *Salix* spp., *Platanus* spp., *Populus* spp., *Carpinus* spp., *Fagus* spp., Moraceae, *Corylus* spp., *Fraxinus* spp., Gramineae, Chenopodiaceae/Amaranthaceae, *Xanthium* spp., Urticaceae were dominate in Sakarya (Bicakci 2006).

CONCLUSIONS

Finally, airborne pollen grains of 28 taxa, 17 of them arboreal and 11 of them non-arboreal were recorded in Savastepe, Turkey in 2002. Pollen grains on slides seen without deductions during the investigation period. The airborne pollen calendar prepared for Savastepe (Fig. 2). We hope the calendar designed by us will be useful for medical treatment of patients' complaining from pollen allergy in Savastepe and its surroundings.

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