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ANALYSIS OF AIRBORNE POLLEN FALL IN USAK, TURKEY

ADEM BICAKCI, R. DUNDAR KOC[*], SEVCAN TATLIDIL, O. NURI BENLIOGLU[*]

Department of Biology,
Science Faculty, Uludag University, Gorukle, Bursa, Turkey.

Abstract

In this study, pollen grains were identified by using Durham sampler in the atmosphere of Usak, Turkey. During the year 2000, a total number of 5,464 grains per cm^2 were recorded. Pollen fall comprised of grains belonging 39 taxa consisting of 25 arboreal, 14 to non-arboreal plants. Total pollen grains consisted of 79.12% from arboreal plants, 18.01% from non-arboreal plants and 2.87% unidentified pollen grains. In the region investigated, *Pinus* spp., Cupressaceae/Taxaceae, *Quercus* spp., Graminea, *Platanus* spp., Chenopodiaceae/Amaranthaceae, *Salix* spp., Urticaceae, *Juglans* spp., *Fraxinus* spp., and Moraceae released the greatest amounts of pollens. During the study period, the pollen fall was highest in May 2000.

Introduction

Nowadays, inhalation allergy is one of the most common disorders where at least 10% of the world population suffer from the manifestations of hypersensitivity (Mygind & Weeke, 1985). There is a strong relationship between disease symptoms and pollen occurrence in the air. Information concerning the occurrence of pollen grains in the air is therefore very important for medical treatment and prophylaxis.

Regular pollen and spore reports and forecasts provided by national aeroallergen networks play the main role in prevention of allergic diseases, therefore a reliable pollen forecast is of great importance for allergologist and for allergic people as well. For this reason, annual pollen calendars have been prepared in many countries (Nilsson *et al*., 1982; Spieksma *et al*., 1989; D'Amato & Spieksma, 1990; Thomas *et al*., 1993; Bicakci *et al*., 1996; 2000, 2003). The aim of the monitoring was to provide information for allergologist and for their patients about the temporary pollen concentration, helping to avoid any allergen. In addition, analysis of these data can provide useful information for plant geography, ecophysiology, ecology and phenology.

Materials and Methods

Usak is situated at 38^0 12' N, 28^0 48' E in western Turkey at an altitude of 750 m above sea level. Usak have European-Siberian, Mediterranean and Irano-Turanian vegetation and generally oceanic climate. There is a mountain, named Murat, in the city where mountain of generally Europea-Siberian vegetation are dominant such as *Pinus sylvestris, Taxus baccata, Populus tremula, Carpinus betulus, Corylus avellana, Fagus orientalis, Acer campestre* subsp. *campestre*, *Frangula alnus* subsp. *alnus, Tilia rubra* subsp. *caucasica, Cornus mas, Ranunculus brutius, Flipendula ulmaria, Rubus canascens, Astragalus glycyphyllos, Lathyrus aurus, Lythrum salicaria* and *Sambucus ebulus.*

[*]Biology Department, Science Faculty, Dumlupinar University, Kutahya, Turkey.

In the investigated area, although a lot of Mediterranean elements such as *Quercus ithaburensis* subsp. *macrolepis, Pinus buritia, Cistus laurifolius, Platanus orientalis, Saponaria mesogitana, Ranunculus rumelicus, Echium italicum, Amni visgana, Plantago holosteum, Ferulago humilis, Centaurea cariensis, Scrophularia canina, Rossularia chrysantha,* are not found.

Irano-Turanian elements comprise of *Silene cappodocica, Aethionema cordatum, Rosa hemisphaerica, Astragalus nitens, A. widemannianus, Onobrychis cornuta, Verbascum coronopifolium, V. phrygium, Scabiosa rotata, Populus tremula, Fagus orientalis, Carpinus betulus, Salix alba, Juniperus excelsa, Juniperus oxycedrus, Quercus cerris, Cistus laurifolius.*

In addition to the natural vegetation around Usak, the species more frequently seen in the parks, gardens and streets of the city are: *Cysticus* sp., *Cydonia japonica, Phyracantha coccinea, Rosa* sp., *Platanus orientalis, Elaegnus angustifolia, Salix* sp., *Aesculus hippocastanum, Acer* sp., *Buxus sempervirens, Cercis siliquastrum, Catalpa bignonoides, Lonicera caprifolium, Cupressus sempervirens, Prunus laurocerasus, Cotoneaster salicifolia, Syringa vulgaris, Hibiscus syriacus, Berberis* sp., *Casuarina equisetifolia, Laurus nobilis, Pittosporum toriba, Campsis radicans, Pinus pinea* and *Cedrus* sp.

In this study, gravimetric method and Durham sampler were used. The Durham sampler was placed on the roof of the office building at a height of 25 m above ground level. Slides placed in the Durham sampler were changed weekly. Before exposure, the slides were coated with glycerine jelly mixed with basic fuchsin (Charpin & Surinyach, 1974). The slides were examined weekly by light microscope. The numbers of pollen grains found in the cover glass area were converted to pollen counts.

Results

A total of 5,464 pollen grains from 39 taxa have been identified in the atmosphere of Usak during one year period. Out of 39 taxa, 25 were arboreal while 14 were non-arboreal plants. A total of 4,323 pollen grains have been found to be arboreal (79.12 %), 984 as non-arboreal (18.01%) and 157 (2.87%) as unidentified (Table 1).

The main pollen producers in the atmosphere of Usak were the following arboreal plants: *Pinus* spp., Cupressaceae/Taxaceae, *Quercus* spp., *Platanus* spp., *Salix* spp., *Juglans* spp., *Fraxinuss* spp., *Moraceae* spp., which form 74.13 % of the total pollen fall (Table1). From herbaceous plants Graminae, Chenopodiaceae/Amaranthaceae and Urticaceae were found frequently in the atmosphere of Usak making upto 13.95 % of the total (Table 1).

Monthly variations of total pollen grains recorded in the atmosphere of Usak during the year 2000 are given in Table 1. The seasonal variation of arboreal and non-arboreal pollen falls is given in Fig. 1. The earliest pollen grains in the atmosphere of Usak were noted in February (Fig. 1). Pollen grains fall began to increase in March and April and reached their maximum levels in May (36.53 %). The numbers of pollen grains were also high in June and July, but the amount of pollens was lower than in spring time. This decrease was correlated with the pollination periods of many arboreal plants which produced and released high amounts of pollen grains in to the atmosphere (Fig. 1). In July, *Pinus* spp., Gramineae, *Plantago* sp., Chenopodiaceae/Amaranthaceae, Umbelliferae, Compositae were recorded as dominant taxa (Fig. 1). In August, there was predominant of Chenopodiaceae/Amaranthaceae, Graminae, *Xanthium* sp., *Centaurea* sp., in September, Chenopodiaceae/Amaranthaceae, *Centaurea* sp., *Artemisia* sp., and in October Chenopodiaceae/Amaranthaceae. No pollen grains were detected in November and December.

Table 1. Annual totals of weekly pollen counts.

Taxa	Total	%
	Arboreal (AP)	
Corylus	6	0.11
Cupressaceae	1064	19.47
Fraxinus	81	1.48
Alnus	11	0.20
Oleaceae	20	0.37
Ulmus	8	0.15
Robinia	6	0.11
Populus	7	0.13
Moraceae	74	1.35
Acer	18	0.33
Pinus	1621	29.67
Quercus	611	11.18
Platanus	401	7.34
Carpinus	6	0.11
Rosaceae	48	0.88
Salix	111	2.03
Juglans	88	1.61
Fagus	39	0.71
Pistacia	26	0.48
Aesculus	8	0.15
Castanea	31	0.57
Cistus	3	0.05
Tilia	1	0.02
Ailanthus	31	0.57
Cedrus	3	0.05
Total AP	**4323**	**79.12**
	Non -arboreal (NAP)	
Rumex	33	0.60
Urticaceae	96	1.76
Compositae	34	0.62
Gramineae	506	9.26
Plantago	42	0.77
Cruciferae	1	0.02
Umbelliferae	32	0.59
Chen./Amaranth.	160	2.93
Caryophyllaceae	3	0.05
Cyperaceae	7	0.13
Rubiaceae	2	0.04
Centaurea	20	0.37
Artemisia	10	0.18
Xanthium	38	0.70
Total NAP	**984**	**18.01**
Unidentified	**157**	**2.87**
Total	**5464**	**100.00**

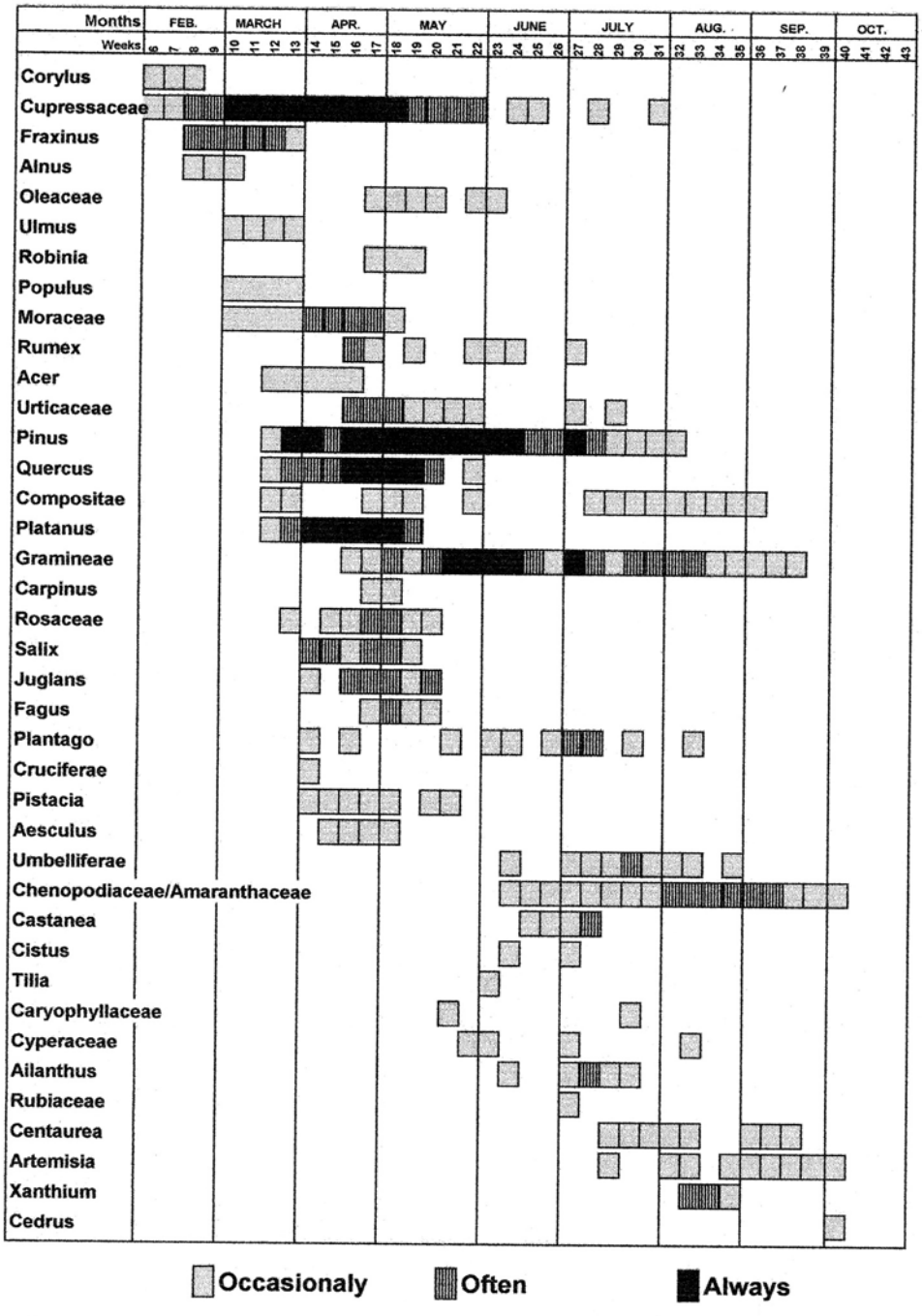

Fig. 1. Pollen calendar of Usak in 2000.

The types of pollens present in the atmosphere of Usak are shown in the form of a pollen calendar (Fig. 1). The following taxa produced the greatest amounts of pollens in the atmosphere of Usak.

***Pinus* spp:** The pollen season started in the third week of March (12th week of year) and ended in the second week of August (32nd week). The highest values were noted in the May.

Cupressaceae: Pollen season started in the first week of February (6th week). The highest values were recorded in first week of May (18th week) and ended in last week of July (31st week).

***Quercus* spp:** The pollen season started in the third week of March. The peak value was noted first week of May and ended in last week of May (21st week).

Gramineae: Pollen grains were recorded during the greater part of the year, from April to September the highest counts were recorded in the second week of June (24th week).

***Platanus* spp:** The pollen season started in the third week of March and ended in second week of May (19th week). In April, high amounts of pollen were recorded .

Chenopodiaceae/Amaranthaceae: Pollen production continued from second week of June to the first week of April (14th week) and lasted upto second week of May.

***Salix* spp:** The pollen season started in first week of April and lasted upto second week of May.

Urticaceae: The pollen season started in the third week of April (16th week) and lasted upto third week of July (29th week). The highest counts were recorded in the last week of April (17th week).

***Juglans* spp:** The pollen season started in the first week of April and ended in third week of May (20th week). The highest value was noted in the 18th week.

***Fraxinus* spp:** Pollen production continued from the third week of February (8th week) to the last week of March (13th week). The highest counts were recorded in the fourth week of April and ended in first week of May.

Moraceae: The pollen season started in first week of March (10th week), peaked in third week of April and ended in first week of May.

Discussion

In the atmosphere of Usak, arboreal pollen types were dominant; this is due to the character of vegetation and geographical location of the town. According to the other studies carried out in Europe, arboreal pollen types are also dominant in Finland (82%) (Koivikko *et al.*, 1986), Burdur, Turkey (76, 1%) (Bicakci *et al.*, 2000), Ostrawiec

Swietokrzyski, Poland (73%) (Kasprzyk, 1996), Perugia (71%) and Ascoli Piceno (55%)(Romano *et al*., 1988), Balikesir (70, 92%) (Bicakci & Akyalcin, 2000) and Bursa, Turkey (70, 01%) (Bicakci *et al*., 1996).

Pollinosis is an allergic disease generally present in atopic individuals (Weiss, 1965). Its prevalence is increasing affecting about 20% of the population, particularly in urban areas (Aberg, 1989; Burr 1992; Miyamoto, 1992; Obtulowicz *et al*., 1995; Thomas *et al*., 1993). Some weeds, certain trees and grasses produce pollen which is widely distributed by air and cause symptoms in susceptible patients. Some important allergic pollens such as *Pinus* sp., *Platanus* sp., Graminae, Cupressaceae, *Quercus* sp., were also found in high concentrations in Usak. In Europe, the dominant airborne species have been determined to be Graminae, *Alnus* sp., *Artemisia* sp., *Urtica* sp., *Betula* sp., in Leiden, the Netherlands (Jager *et al*., 1991); Graminae, Urticaceae, Oleaceae, *Artemisia* sp. in Ascoli Piceno, Italy (Romano *et al*., 1988); *Betula* sp., *Pinus* sp., *Alnus* sp., *Platanus* sp., *Plantago* sp. in Brussels, Belgium(Jager *et al*., 1991); Pinaceae, *Alnus* sp., *Betula* sp., *Quercus* sp., Graminae, *Artemisia* sp., in Jyvaskylan, Finland (Koivikko *et al*., 1986); *Alnus* sp., *Betula* sp., Graminae, *Corylus* sp., in Ostrowiec Swietokrzyski, Poland ; *Betula* sp., *Quercus* sp., Graminae, Urticaceae in Vienna, Austria (Jager *et al*., 1991). The airborne pollen types mentioned above are responsible for many cases of pollinosis in Europe.

Pollen grains of 39 taxa were determined during the pollen season in the atmosphere of Usak, of which 11 formed about 88.08 % total spectrum. In the region investigated, pollen grains reached their maximum levels in May. The presented calendar of palynological changes indicates the necessity for individual treatment according to diagnosed sensitisation to given allergens. The very low prevalence of highly allergenic pollens of trees and grasses in total pollen count supports the long lasting tradition of Usak as a health resort for the treatment of allergic diseases.

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