

Airborne pollen grains in Ajlun, Northern Jordan

Granos de polen en suspensión en Ajlun, Norte de Jordania

Saleh Al-Quran

Department of Biology, Faculty of Science, Mutah University, Karak, JORDAN. salquran@gmail.com

Abstract

The related factors concern the dates of the appearance of pollen grains in the air, the duration of the presence of sporomorphs and the maximum concentrations in particular seasons were investigated. The aim of the study was to compare the airborne concentrations of allergenic pollen produced by three dominant early flowering tree taxa (*Cupressus*, *Pinus*, and *Olea*) in the three different sites (A: Ajlun city, C: Castle, D: Debbeen) of Ajlun during the years 2006–2007. Measurements were performed by the volumetric method. Pollen seasons were defined as the periods in which 95% of the total catch occurred. Significant differences in the pollen count of the examined taxa were observed between two seasons: the pollen count of *Cupressus* was higher in 2006 than in 2007, while for *Pinus* and *Olea* the opposite was the case. The highest concentration and annual pollen count of *Pinus*, *Cupressus*, and *Olea* were measured in Ajlun in both seasons, while the highest annual pollen counts of *Pinus* and *Olea* were noted in Ajlun site, where the annual pollen count of *Olea* in 2007 was four times higher than in 2006 and equaled 4,215 grains in m³ per 24 h. The longest pollen seasons were observed at low annual pollen counts for the pollen of *Cupressus*. Results of the study reveal significant differences between the seasons and the cities. The pollen counts of *Cupressus*, *Pinus* and *Olea* trees are determined by the weather, diversity of local flora and specific rhythm of pollination of particular taxa.

Key words: pollen grains, airborne pollen, Ajlun, Jordan

Resumen

Se investigó sobre los factores relacionados a la aparición de granos de polen en el aire, su tiempo de permanencia y las concentraciones máximas en estaciones particulares. El objetivo del estudio fue comparar las concentraciones del polen alergénico producido por tres taxones dominantes de árboles de floración temprana (*Cupressus*, *Pinus* y *Olea*) en tres sitios diferentes (A: Ciudad de Ajlun, C: Castle, D: Debbeen) de Ajlun, durante los años 2006-2007. Las mediciones se realizaron mediante el método volumétrico. Las temporadas de polen fueron definidas como los periodos en que se capturó el 95% del total producido. Diferencias significativas en el nivel de polen de los taxones examinados se observaron entre dos estaciones: la cantidad de polen de *Cupressus* fue mayor en 2006 que en 2007, mientras que para *Pinus* y *Olea* ocurrió lo contrario. La mayor concentración y cantidad de polen anual de *Pinus*, *Cupressus*, y *Olea* se midieron en Ajlun en ambas temporadas, mientras que los más altos conteos anuales de polen de *Pinus* y *Olea* se observaron en el sitio Ajlun, donde el nivel de polen de *Olea* anual en 2007 fue cuatro veces más que en 2006, equivalente a 4215 granos en un m³ por 24 h. En las temporadas más largas de polen se observaron conteos bajos para el polen de *Cupressus*. Los resultados del estudio revelan diferencias significativas entre las estaciones y las ciudades. Los recuentos de polen de los árboles de *Cupressus*, *Pinus* y *Olea* están determinadas por el clima, la diversidad de la flora y ritmo específico de la polinización de los taxones en particular.

Palabras clave: granos de polen, polen en el aire, Ajlun, Jordania

Introduction

Ajlun is characterized by woodland vegetation and located in the mountains of northern Jordan. It was investigated and quantitatively surveyed to

determine the annual pollen counts and the different taxa constituting the airborne pollen grains. The dominant trees are: Three *Quercus* tree species (*Quercus calliprinos* Webb, *Q. ithaburensis* Decne

L.), *Cupressus sempervirens* L. (cypress), *Olea europaea* L. (Olive tree) *Platanus orientalis* (Oriental Plane), *Pinus halepensis* (Halap Pine), *Prunus laurocerasus* (Cherry Laurel), *Rosa canina* (Wild Rose), *Populus* spp. (Poplar) and *Salix* sp. (Willow) and *Arbutus andrachne* (Strawberry Tree), *Rubus sanctus* are frequently seen in the springs' sides. While several shrubs (*Styrax officinalis* L., *Cistus creticus* L., *Cistus salviifolius* L., *Atriplex halimus* L., *Calycotome villosa* (Poir.) Link, *Retema raetam* L. and *Sarcopoterium spinosum* (L.) Spach., *Hypericum calycinum*, *P. pinaster*, *Antirrhinum majus* (Snapdragon), *Linaria genistifolia*, *Laurus nobilis* (Laurel), dominate the woody vegetation in the investigated area. Lower altitudes of south-west facing slopes mainly with *Cercis siliquastrum* (Judas Tree), *Juniperus* spp., *Ligustrum vulgare* (Ligustrum), *Morus alba* (White Mulberry) and *Nerium oleander* demonstrate generally the higher plant densities than the higher altitudes of north-east facing slopes (Al-Quran, 2004; Davis, 1969; Leuchner & Bohem, 1982; McDonald, 1980; Minero *et al.*, 1999; Speiksma & Noland, 1991).

Jordan lies between longitudes 350 40' and 390 E and between latitudes 290 30' and 340 N with moist cold winters and dry hot summers. It is of great interest in vegetation ecology because it is the meeting place of the Mediterranean, Irano-turanian and Saharo-arabian regions and the Nubo-sindian region. For this reason there are conspicuous changes in the vegetation and in the composition of the flora over relatively short distances (within 30 km on the western slopes of the border mountains) related to the highly fluctuations in topographic factors (Al-Eisawi & Dajani, 1983; Al-Quran, 2004; Zohary, 1973).

The study area is located 10 km west of Ajlun city near Rabad castle within Ajlun mountains at an elevation from 1000-1400 m above the sea level. This area is dominated by Mediterranean habitat since it is influenced by the westerly fronts' currents associated with winter precipitation, so the cold snowy winter is the general climate. The mean annual precipitation is

of 660 mm in winter while the spring months tend to be wetter with average precipitation about 200mm. The mean summer temperature is 240 C while from 2-60 C is the average winter temperature. Transpiration rates are 1300 mm/year. rocks with 6.5-7.0 PH, the soil texture ranges from loamy silt to silt clay to gravel clay.

This study needs to be framed fully in terms of the following concrete research questions: 1. What are the taxa that have the palynological importance value altered the Ajlun forest stand and species composition? 2. What is the total pollen count estimated from this rich area with pollen composition. 3. How does the vegetation density vary in relation to the Pollen types investigated? these three research questions are the vital ones to draw a clear image about the Airborne pollen of this investigated area of Ajlun subject of Oak forests in Jordan.

It is worthful to say that this survey of airborne pollen in Ajlun woodlands inform of concrete representative data is very important and still be the comprehensive purpose of this study which might be helpful in characterizing the pollen types dominated within the investigated area for the benefits of human whose the center of the ecosystem. Ajlun area is very important from both agricultural and touristic viewpoints, so this promotes my curiosity to fulfill this study, but there is no possible to consider the quantification of human impact as from the aims of this study (Molina *et al.*, 2001; Moore & Web, 1978; Norris-Hill, 1999; Porsbjerg *et al.*, 2003).

The atmospheric pollen concentrations have been studied in several situations, including agricultural aspects, environmental importance and allergic diseases. These noticed phenomena have aroused a greater worldwide interest in knowing the pollen content of the atmosphere of different localities in aquatic habitats as well as in towns and cities. Knowledge of the local flora, native, endemic or introduced, enhances the probability of correctly identifying pollen grains which can affect human activities. There is an evidence all over the world that the prevalence of allergic diseases induced

by pollen has increased and depended on palynological back grounds. Many reasons are probably behind the increasing or decreasing of the number of pollen grains in the atmosphere especially the weather conditions such as temperature, rainfall and wind speed. The aim of this pollen airborne study (Mishra, 2002; Ribeiro *et al.*, 2003) is to present the results of two years (2006-2007) of continuous gravimetric sampling of airborne pollen in the Ajlun atmosphere, their percentage values, pollen season periods and pollen concentrations in relation to some climatic factors. Almost 55 % of the land of Ajlun is forest, 45% is shrubbery, cultivated meadowy and pasture. Species. In addition to natural vegetation of Ajlun, the following species are frequently seen in the parks, gardens and streets of the city: *Acacia* spp. (Wattle), *Acer* spp. (Maple), *Catalpa bignonioides* (Indian bean Tree), *Cedrus libani* (Cedar of Lebanon), *Cupressus sempervirens* (Italian Cypress), *Elaeagnus angustifolia* (Oleaster), *Fraxinus excelsior* (Common Ash), *Juglans regia* (Walnut), *Salix babylonica* (Chinese Weeping Willow).

Material and methods

In this study, counts of airborne pollen grains in three altitudinally different sites in Ajlun were investigated by using the volumetric Burkard traps. They were used in this study to collect the atmospheric pollen gains polluting the air. They were calibrated 10 l of air per minute passed through the trap and it was checked weekly. They were fixed on the roof of the hilly place about 10 meters from the ground level of the neighboring regions at three sites: (1) Ajlun city: A (2) Rabad castle: C (3) Debbeen: D. These sites where the traps were fixed, are surrounded by many topographic counter heights. So the fixed position of the trap cannot be used as a factor affecting the natural results of pollen distribution and atmospheric pollen pollution. The total pollen counts were calculated, slides from strips of weekly ribbon were prepared for further investigation. It is possible recently after the technical progress to carry out now the atmospheric pollen counts which

was not possible before thirty years ago. The data collected for the daily and monthly pollen counts have been expressed in terms of number of pollen grains per cubic meter of the air. The data collected were expressed in term of each year first as separately, then in terms of two years together to show if there is any annual variation to give more accuracy and credibility to the study (Banik & Chanda, 1992; Bosquet *et al.*, 1984; Davies *et al.*, 1963; Erdtman, 1960; Faegari & Iversen, 1975; Feinbrun *et al.*, 1959).

The identification and counting of pollen grains were determined at least up to family, genus and some to species levels. The numbers of pollen grains found in the cover-glass area (24 mm × 50 mm) were counted. The meteorological data for Ajlun were derived from the records of the Meteorological Department in Amman.

Results

A comparison of hazel pollen observed in the three sites of Ajlun over a period of two years has shown that in the season of 2006, the pollination of this taxon began the earliest in Ajlun city (A) site where the pollen count was the lowest. In Rabbad castle (C), the beginning of pollination was three weeks later than in Ajlun city and two weeks later than in Debbeen (D). The highest pollen count of *Cupressus* was found in Ajlun city in both observation seasons, and the peak of pollination in Ajlun city in 2006 coincided with that in Debbeen, but was two weeks earlier than in Ajlun city. The highest annual count of this pollen was measured in 2007 in Ajlun. In 2006, the *Cupressus* pollen count was generally lower than in 2007. In 2007, a high pollen count of over 50 grains in m³ per 24 h was noted in Rabbad castle site as early as the end of February (Grandjouan *et al.*, 2000; Green *et al.*, 2003; Halwagy *et al.*, 1984; Karim & Al-Qura'n, 1988; Latalowa *et al.*, 2002).

Table 1: Results of aerobiological study of tree pollen counts in the atmosphere of Jordan cities.

Ajlun site		Ajlun city (A)		Rabbad castle (B)		Debbeen (D)	
		2006	2007	2006	2007	2006	2007
<i>Cupressus</i>	ps	22.03–27.05	18.03–21.05	01.03–21.05	27.2–10.05	10.03–25.05	8.03–19.05
	n	834	723	465	387	541	229
	max	219	134	116	127	111	124
<i>Pinus</i>	ps	19.03–27.04	18.03–27.04	4.03–24.04	12.03–23.04	11.03–27.04	13.03–26.04
	tn	1372	4212	928	818	594	1082
	max	265	1140	195	159	108	224
<i>Olea</i>	ps	11.05–29.05	13.05–28.05	21.04–15.05	25.04–20.05	29.04–25.05	24.04–22.05
	tn	9854	13547	5338	12121	4626	8147
	max	3762	2164	1334	3210	1725	1375

ps – pollen season, tn – total number of pollen grains collected in the season, max – maximum number of pollen grains / 24 hours.

In the middle of March we noted in Rabbad castle another increase of the pollen count of hazel coincident with the pollination peak in Debbeen. In the season of 2006, the beginning of *Pinus* pollination in Rabbad castle was one week earlier than in the other two cities. The highest count of cypress tree pollen of about 300 grains in m³ per 24 h was observed in Rabbad castle at the beginning of the third week of February. In the other cities the pollen count was lower, and the pollination peaks were by 4–7 days later than in Rabbad castle. In the season of 2007, the Pine tree pollen count reached very high values in Ajlun city, rising in the middle of March to over 2,100 grains in m³ per 24 h, while in Debbeen, its highest value was 1,050 grains in m³ per 24 h, and the pollination peak was noted six days earlier than in Ajlun city. In Rabbad castle, the olive pollen count was very low with only a few grains in m³ per 24 h, and was observed in the period not coinciding with the time of pronounced pollination noted in the other two sites.

The highest annual pollen count of Olive measured in 2007 in Ajlun city was five times higher than in 2007. In Debbeen and Rabbad castle the annual pollen counts of this taxon were also higher in 2007. A long pollination period was observed for *Cupressus* in Rabbad castle, with low annual total counts of sporomorphs. For *Pinus*, a very short pollination period was noted in Ajlun city in 2007 (27 days). In the other sites during the two seasons studied, the duration of the pollination periods

was comparable (over 50 days). The pollination period of birch trees was relatively short and of similar duration of over 20 days in the two seasons and in all the cities studied (Rodriguez *et al.*, 2000; Speiksma *et al.*, 1989).

The highest annual count of *Pinus* was measured in 2007 in Ajlun city. The course of pollination of pine trees was well pronounced and similar in both seasons in Rabbad castle and Debbeen. The beginning of pollination was observed at the same time in all the sites. In the season of 2006 the highest pine tree pollen count of over 2,008 grains in m³ per 24 h was observed in Rabbad castle. In this site the peak of pollination occurred a few days earlier than in the other two sites. In 2007 in Ajlun city, the olive tree pollen count reached over 4,800 grains in m³ per 24 h, which was the highest value in the cities studied during the whole time of observation. In Rabbad castle, the maximum pollen count was over 3,900 grains in m³ per 24 h, while in Debbeen over 3,000 grains in m³ per 24 h. In Rabbad castle the maximum value was noted one week earlier than in Ajlun city and Debbeen.

Discussion

The much higher pollen counts of *Olea* in Debbeen and Ajlun city in 2007 than in 2006 can be explained by the natural rhythm of pollination of these trees. *Olea* shows a two-year rhythm of more pronounced pollination. The results obtained may indicate the occurrence of the cross-reactivity between different

pollen grains especially of the period of the presence of airborne pollen grains mixture together during the period of pollination which may coincide with the pollen season of other trees. In Jordan some tree pollen rarely produces allergic reactions, despite its local high concentration. The differences noted in the character of pollination of the three trees studied indicate the significant difference for local observations to be carried out.

The results presented above testify to significant differences in the pollen counts of the three taxa studied between the sites in particular seasons and between the seasons. The concentration of pollen grains in the air over a site is determined by the individual rhythm of plant pollination, meteorological conditions, composition of local flora, geographic location and kind of urban structure (loose or compact housing, areas with many gardens or with scarce vegetation, industrial areas, agricultural areas or forests). The differences in the beginning of pollination of *Pinus* and *Cupressus* noted in 2006 are most probably due to the weather conditions which are known to affect their pollination, as indicated by Rabbad castle.

Conclusion

The pollen counts of the taxa studied differ in both seasons at the time of grain appearance in the air, the period of pollen grains presence in the air and the maximum values of pollen counts.

The differences in the time of the beginning of pollination were significant only in the season of 2000. In Rabbad site, the pollen of *Cupressus* appeared in the air 2–3 weeks earlier than in Ajlun city and Debbeen, and the pollen *Pinus* - one week earlier than in Ajlun city and Debbeen.

The highest pollen counts and annual total pollen counts of *Cupressus* were noted in Rabbad castle in both seasons, and those of *Pinus* and *Olea* in Ajlun city in 2007.

The differences in the pollen counts of particular taxa in the two seasons were also significant. The pollen count of *Cupressus* was higher in 2006 than in 2007,

while for *Pinus* and *Olea* the opposite was the case. In 2006, the pollen count of *Cupressus* in all the sites was from 1.3–3 times higher than in 2007. The pollen count of *Pinus* in 2007 in Ajlun city and Debbeen was from 12–20 times higher than in 2006. The pollen count of *Olea* in Ajlun city and Rabbad castle was from 3–4 times higher in 2007 than in 2006.

In Rabbad castle in both seasons, the hazel and alder pollen counts were very low compared to those in Ajlun city and Debbeen. These differences may be due to a different composition of local flora and the influence of weather.

Literature cited

- Al-Eisawi, D. & B. Dajani.** 1983. Aerobiology: Pollen counts study in Jordan. Proc. XII Congr. Eur. Acad. Allergol. Clin. Immunol, Rome.
- Al-Quran, S.** 2004. Pollen morphology of Plantaginaceae in Jordan, Pak.J.Biol.Sci.,7(8):1586-1593.
- Al-Quran, S.** 2004. Pollen morphology of solanaceae in Jordan, Pak.J.Biol.Sci.,7(9):1586-1593.
- Banik, S. & S. Chanda** 1992. Airborne pollen survey of Central Calcutta, India in relation to college relation to allergy. Grana, 31: 72-75.
- Bosquet, J. P.; Cour, B. Guerin & F. Michel.** 1984. Allergy in the Mediterranean area. I. Pollen counts and pollinosis of Montpellier. Clin Allerg, 14: 249-258.
- Davies, R.; M. Denny & L. Newton.** 1963. A comparison between the summer and autumn air spores in London and Liverpool. Acta Allerg. 18;131-147.
- Davis, R.** 1969. Spore concentration in the atmosphere at Ahmadi, a new town in Kuwait. J.Gen.Microbiol. 55:425-432.
- Erdtman, G.** 1960. The acetolysis method, a revised description, Seven. Bot. Tidsker 54:561-564.
- Faegari, K. & J. Iversen.** 1975. Text book of pollen analysis, 3rd ed. Munksgard, Copenhagen.
- Feinbrun, N.; T. Rahat & J. Tas.** 1959. Further studies in atmospheric pollen in Jerusalem. Bull. Res. Council. Israel 8D:31-40.
- Grandjouan, G; P. Cour & R. Gros.** 2000. Reliability of abundance ratios between aeropalynological taxa as indicators of the climate in France. Grana, 39: 182-193.
- Green, B.; E. Panula; M. Dettmann; S. Rutherford & R. Simpson.** 2003. Airborne *Pinus* pollen in the atmosphere of Brisbane, Australia and relationships with meteorological parameters. Aerobiologia, 19: 45-53.

- Halwagy, M. & R. Halwagy.** 1984. Seasonal distribution of pollen grains in the atmosphere of Kuwait. *Pollen spores* 26:201-216.
- Karim, F. & S. Al-Qura'n.** 1988. Wild flowers of Jordan, Yarmouk University Press. Irbid, Jordan.
- Latalowa, M.; M. Miteus & A. Uruska.** 2002. Seasonal variations in the atmospheric *Betula* pollen count in Gdarisk (Southern Baltic Coast) in relation to meteorological parameters. *Aerobiologia*, 18: 33-43.
- Leuchner, R. & G. Bohem.** 1982. Pollen and inorganic particles in the air of climatically very different places in Switzerland. *Grana*, 20: 161-167.
- McDonald, M.** 1980. Correlation of airborne grass pollen levels with meteorological data. *Grana*, 19: 53-56.
- Minero, F.; J. Morales; C. Thomas & P. Candau.** 1999. Relationship between air temperature and start of pollen emission in some arboreal taxa in South-western Spain. *Grana*, 38: 306- 310.
- Mishra, R.** 2002. Airborne pollen flora of Jabalpur- the central India. *Aerobiologia* 18:73-81.
- Molina, R.; I. Palacios; A. Rodriguez; J. T. Munoz & A. Corchero.** 2001. Environmental factors affecting airborne pollen concentration in anemophilous species of *Plantago*. *Ann Bot*, 87: 1-8.
- Moore, P. & J. A. Web.** 1978. An illustrated guide to pollen analysis, Hodder and Stoughton, London.
- Norris-Hill, J.** 1999. The diurnal variation of Poaceae pollen concentrations in rural area. *Grana*, 38: 301-305.
- Porsbjerg, C.; A. Rasmussen & V. Backer.** 2003. Airborne pollen in Nuuk, Greenland, and the importance of meteorological parameters. *Aerobiologia*, 19: 29-37.
- Ribeiro, H.; M. Cunha & I. Abreu I.** 2003. Airborne pollen concentration in the region of Braga, Portugal, and its relationship with meteorological parameters. *Aerobiologia*, 19: 21-27.
- Rodriguez, A.; I. Palacios; R. Molina; A. Corchero & I. T. Munoz.** 2000. Dispersal of Amaranthaceae and Chenopodiaceae pollen in the atmosphere of Exramadura (SW Spain). *Grana*, 39: 56-62.
- Speiksma, F.; G. Frenguelli; A. Nikkels; G. Minci-grucci; L. Smitvis; E. Bricci & W. Dankaat.** 1989. Comparative study of airborne pollen concentrations in central Italy and the Netherlands, 1982-1985. *Grana*, 28: 25-36.
- Speiksma, F. & N. Nolard.** 1991. Fluctuations and trends in airborne concentrations of some abundant pollen types, monitored at Vienna, Leiden and Brussels. *Grana*, 30: 309-312.
- Zohary, M.** 1973. Geobotanical foundations of the middle east, Gustav Fisher Verlag. stuttgart. pp 43-67



Al-Quran, Saleh A. 2011. "Airborne pollen grains in Ajlun, Northern Jordán." *Arnaldoa : revista del Herbario HAO* 18(2), 179–184.

View This Item Online: <https://www.biodiversitylibrary.org/item/156101>

Permalink: <https://www.biodiversitylibrary.org/partpdf/279146>

Holding Institution

Missouri Botanical Garden, Peter H. Raven Library

Sponsored by

Missouri Botanical Garden

Copyright & Reuse

Copyright Status: In copyright. Digitized with the permission of the rights holder.

Rights Holder: Herbario Antenor Orrego, Universidad Privada Antenor Orrego, Museo de Historia Natural

License: <http://creativecommons.org/licenses/by-nc-sa/3.0/>

Rights: <https://www.biodiversitylibrary.org/permissions>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.