

Short Communication

An annual study of airborne pollen in northern Mexico City

Irene Bronillet Tarragó

Tecualiapan # 36-IX-6 Mexico, D.F., 04320 Mexico

Received 1 March 1994; revised 19 December 1995; accepted 28 June 1996

Abstract

An investigation of airborne pollen in northern Mexico City was carried out for one year. A total of 24 taxa were identified and classified according to the growing form in pollen of trees, weeds and grasses. Pollen grains were recorded all year round with a peak in December. The trees group showed the highest quantity of pollen as well as taxa diversity, although its peak period was in the dry season. The weeds and grasses emitted a larger quantity of pollen in the rainy season. The dominant taxa were *Alnus*, *Casuarina*, Compositae and Gramineae. As for their relation with meteorological parameters, we found that the increase of pollen concentration was related to high temperatures, low relative humidity and high wind speed, the latter causing an increase of airborne pollen with no dilution at all. The hours with the highest pollen concentration were from 16:00 to 18:00.

Keywords: Aerobiology; Airborne pollen; Mexico

1. Introduction

Nowadays, one of the most serious problems that affects Mexico City is its atmospheric pollution, caused not only by the gases emitted by cars and industries but also by the particles suspended in the air. In the biological fraction pollen grains are found; they may have allergenic features that alterate the quality of life of the population. This makes aeropalynological studies essential, not only to achieve the elements that could help improving the quality of life, but also to know the biology and behavior of pollen grains in the atmosphere.

Therefore a study of airborne pollen was undertaken in northern Mexico City with the purpose of knowing the types and abundance of pollen in the air, their dominance as well as their seasonal and diurnal variation, and their relationship with some meteorological parameters.

2. Materials and methods

The sampling was carried out during a year (from November 1990 to October 1991) using a seven-day recording Burkard spore trap, placed at the roof top of a building at about 10 m above the ground, inside the Instituto Mexicano del Petróleo, located in the northern area of the Federal District of Mexico City (Delegación Gustavo A. Madero). The samples were prepared according to the Burkard Manual (1990). Microscopy was performed with a ZEISS Microscope model K-7-D-Phot2, and hourly and daily counts were carried out according to Kämpylä and Penttinen (1981). For the pollen identification books and atlas (Pla-Dalmaú, 1961; Wodehouse, 1965; Lieux, 1980a,b, 1982; Faegri and Iversen, 1984; Smith, 1984; Rosales, 1985), and reference slides were used.

The different pollen types were classified according to their growth form in pollen of trees, weeds and grasses.

The abundance and frequency of appearance of each identified taxa and group were obtained.

The pollen results were separated according to the two seasons that characterize Mexico City: a dry season from November to April, and a rainy season from May to October. Temperature, relative humidity and wind speed parameters for each season were registered in order to verify a possible correlation with the pollen content.

The dominant taxa for each season were determined using the Olmsted-Tukey analysis and working out squaring graphics (Sokal and Rohlf, 1981).

3. Results

A total of 24 taxa were identified (Table 1).

The highest pollen concentration was obtained during the dry season with a total of 17 637 grains/m³ (84.6% of the annual total) and two peaks were recorded: one in December and another one in March. Both of them were related to the presence of trees, which have to be considered as seasonal. During the rainy season, a peak was observed in August, related to an increase in weed pollen. The weeds, as well as the grasses, showed a homogeneous behavior throughout the year of investigation. Yet the pollen concentration of both types increased considerably when rain showed up (Fig. 1).

The highest concentration of tree pollen was due to the fluctuations of temperature and low percentages of relative humidity. The presence of rain instead, caused a decrease of tree pollen and an increase of that of weeds and grasses (Fig. 2).

As for the diurnal variation of the three pollen types a gradual increase in the pollen concentration was observed from 1000 h, coinciding with an increase in temperature and a decrease in relative humidity. The

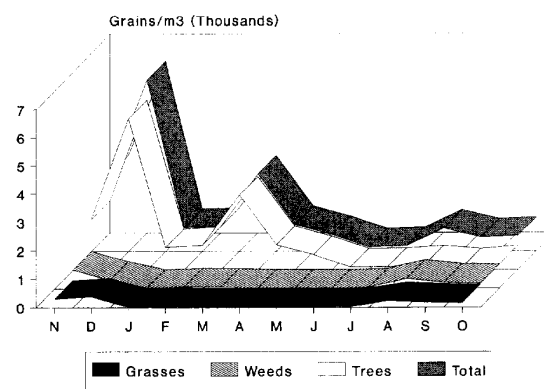


Fig. 1. Annual pattern of pollen grains.

pollen peak was recorded in the afternoon, between 1600 and 1800 h (Fig. 3).

By means of the Olmsted-Tukey analysis the dominant taxa were identified for each season. For the dry season they were *Alnus*, aff. *Callistemon*, *Casuarina*, Cupressaceae, *Eucalyptus*, *Fraxinus*, *Quercus*, *Pinus*, Chen-am, Compositae and Gramineae; and the most abundant were *Alnus* (tree), Compositae (weed) and Gramineae (grass). For the rainy season they were *Casuarina*, Cupressaceae, *Pinus*, Chen-am, Compositae and Gramineae, and the most abundant were *Casuarina*, Compositae and Gramineae (Fig. 4).

The monthly variation of the dominant taxa according to season and growth form were as follows (Fig. 5): *Alnus*. It was recorded exclusively in the dry season and was the genera that contributed the highest quantity of pollen during this season. The maximum concentration was registered in December, influenced, perhaps, by low temperature and relative humidity of around 50%.

Casuarina. This genera is characterized by two flowering periods throughout the year, the first one from February to March and the second one in August. In this study it was recorded all the year round, even if it showed two distinct peaks, one in November and the other in March.

Compositae. Its flowering period occurs during the rainy season. The highest concentration was recorded in November.

Gramineae. Like the Compositae, the grasses showed their highest concentration in December during the rainy season.

The daily behavior of the dominant taxa was the same for all groups.

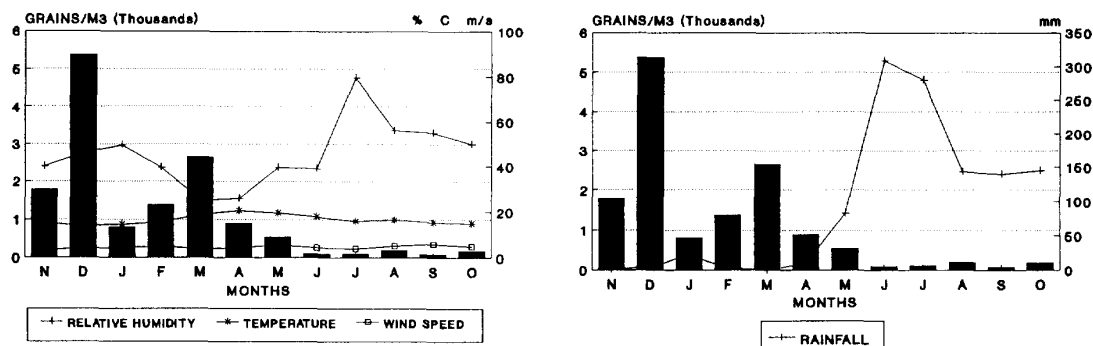
4. Discussion and conclusions

The months with the highest pollen concentration were December and March. In particular, the greatest

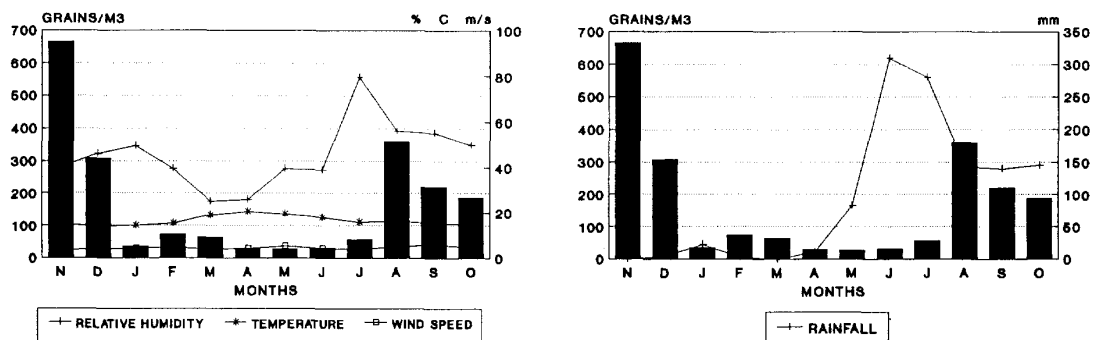
Table 1
Identified taxa

Trees	Weeds	Grasses
Abies	Chenam	Cype raceae
Acer	Compositae	Gramineae
Alnus	Cruciferae	
alf. Callistemon	Leguminosae	
Casuarina	Onagraceae	
Cupressaceae	Urticaceae	
Eucalyptus	Rumex	
Fraxinus		
Ligustrum		
Liquidambar		
Pinus		
Populus		
Quercus		
Salix		
Schinus		

MONTHLY VARIATION OF TREE POLLEN.



MONTHLY VARIATION OF SHRUBS POLLEN.



MONTHLY VARIATION OF GRASSES POLLEN.

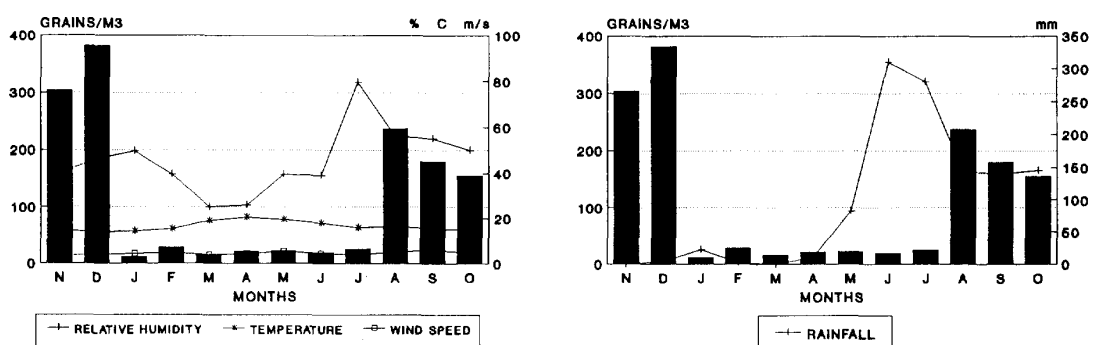


Fig. 2. Correlation between pollen grains and meteorological parameters.

quantity of pollen was recorded in December (twice as much than in March). This means that a high production of pollen took place in that month, or perhaps in the month before.

The tree pollen group was the richest and most abundant during both seasons but the number of taxa as well as the concentration were higher in the dry season, decreasing considerably during the rainy sea-

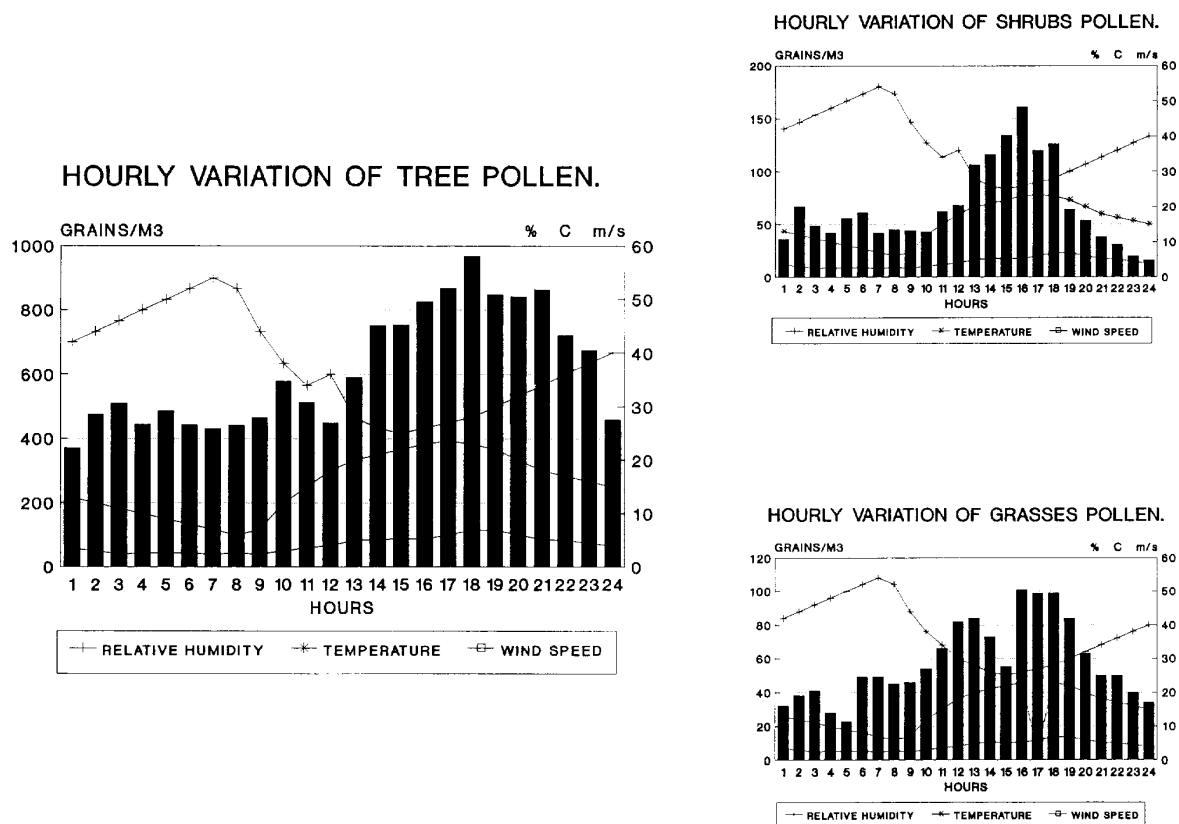


Fig. 3. Hourly variation of total grains (trees, weeds and grasses).

son. This means that the main period of dispersion of tree pollen takes place between November and April. On the other hand, the number and concentration of weed and grass pollen began to increase in May, therefore, the rainy season, is the period of highest production of these two groups.

As for the dominant taxa, we found that *Casuarina*, Compositae and Gramineae do not show any seasonality. This could be because they do not have specific climatic needs or because they produce a large quantity of pollen, which is kept suspended, even after their flowering period. *Alnus* has a different behavior, being a strictly seasonal genus.

The annual behavior of the total pollen grains could be related to meteorological parameters, coinciding in general with the reports of Pla-Dalmaú (1961), Edmonds (1979) and Rosales (1985). The peak pollen concentration was recorded in December when the lowest average temperature occurred, which would not help the suspension and dispersion of pollen in the atmosphere. Thus, such high quantity of airborne pollen seemed to be due to the low relative humidity, that helps keeping pollen grains suspended and to the wind speed (average of 4 m/s).

As for the daily variation, the peak concentration for all the taxa was recorded during the second half of the day, between 1600 and 1800 h. Pla-Dalmaú (1961) reports two periods of anthesis related to an increase of the temperature: One at 0900 h when an intense desiccation help the production and the liberation of pollen; and the second after the 1400 h because of a greater sensibility to warm temperature in the anthesis period. The peak was attained at 1600 h which coincide with what we found in this study. In the case of *Alnus* the highest concentration was recorded during the night, when the temperature decreases and the relative humidity begins to increase.

The results presented in this paper are part of a greater project, carried out at three sites of Mexico city, and should be seen as a first step to understand the behavior of airborne pollen in this area.

Acknowledgements

The present study has been carried out with the support of the Instituto Mexicano del Petróleo.

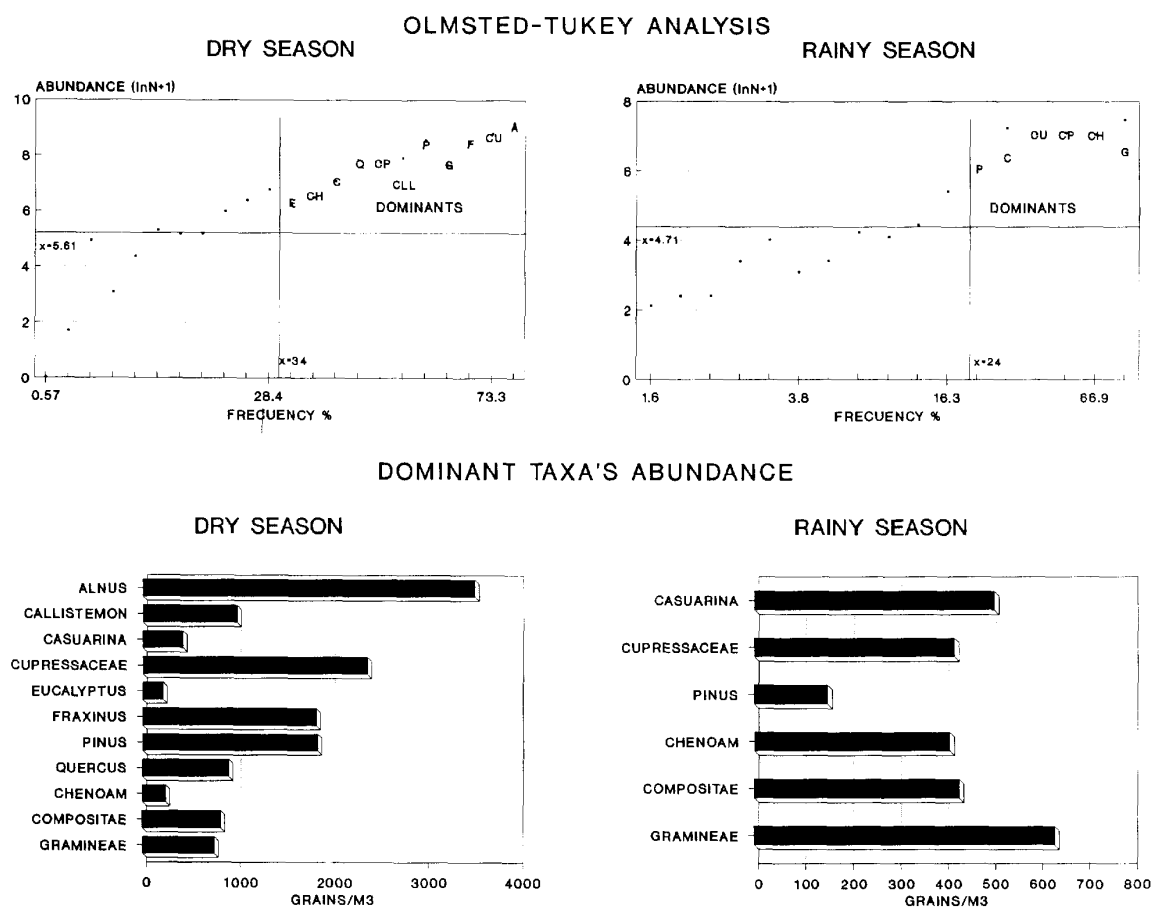


Fig. 4. Olmsted-Tukey analysis and dominant taxa's abundance.

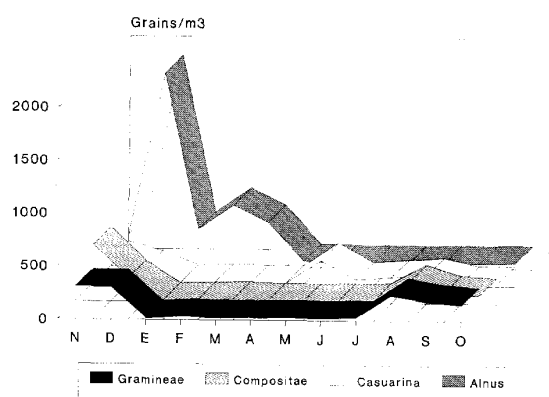


Fig. 5. Annual variation of the dominant taxa.

References

- Edmonds, R. (1979) *Aerobiology, The Ecological System Approach*. Dowden, Hutchinson and Ross, PA.
- Faegri, K. and Iversen, J. (1984) *Textbook of Pollen Analysis*, 2nd edn. Hafner, New York.
- Käpyla, M. and Penttinen, A. (1981) An evaluation of the microscopical counting methods of the trap in Hirst-Burkard pollen and spore trap. *Grana* 20, 131–141.
- Lieux, M.H. (1980a) An atlas of pollen trees, shrubs and woody vines of Louisiana and other southeastern states. Part I. Ginkgoaceae to Lauraceae. *Pollen et Spores* 22, 17–57.
- Lieux, M.H. (1980b) An atlas of pollen trees, shrubs and woody vines of Louisiana and other southeastern states. Part II. Platanaceae to Betulaceae. *Pollen et Spores* 22, 191–243.
- Lieux, M.H. (1982) An atlas of pollen trees, shrubs and woody vines of Louisiana and other southeastern states. Part IV. Sapotaceae to Fabaceae. *Pollen et Spores* 24, 331–368.
- Pla-Dalmau, J.M. (1961) *Polen. Talleres Gráficos D.C.P. Gerona*.
- Rosales, L.J. (1985) *Análisis aeropalínológico anual del norte de la Ciudad de México, implicaciones en la contaminación ambiental y en la alergología*. Tesis de Licenciatura. Facultad de Ciencias, UNAM, México.
- Smith, E.G. (1984) *Sampling and Identifying Allergenic Pollens and Molds*. Blewstone Press, USA.
- Sokal, R.R. and Rohlf, F.J. (1981) *Biometry*. W.H. Freeman, USA.
- Wodehouse, R.P. (1965) *Pollen Grains*, 3rd edn. Hafner, New York.