

Pla a 1 in the bioaerosol of Valladolid (Spain) and its implications on public health

S. De Castro-Alfageme¹, D. Fernández-Gonzalez^{1,4}, A.I. Calvo², A. Castro², E. Alonso-Blanco³, R.M. Valencia-Barrera¹, A.M. Vega-Maray¹, Z. González-Parrado¹, P. Mandrioli⁴ and R. Fraile²

¹Department of Biodiversity and Environmental Management, University of León, León, 24071, Spain ²Department of Physics (IMARENAB), University of León, León, 24071, Spain ³CIEMAT, Madrid, 28040, Spain ⁴ISAC-CNR, Bologna, 40129, Italy Keywords: allergen, *Platanus* pollen, air pollutants, Spain. Presenting author e-mail: casalfsa12@gmail.com

Introduction

Platanus acerifolia (Aiton) Willd. (Fig. 1) is an abundant ornamental plant in the world. In the city of Valladolid (Spain) the different methods of pruning affect the flowering of plane tree.

Primary biogenic particles emitted by vegetation form part of bioaerosols, and also including among others, pollen grains and small fragments of plants (Després *et al*, 2007).

Pla a 1, the major allergen of *Platanus* pollen (Fig. 2), is a 18 kDa protein nonglycosylated associated with invertasa inhibitors (Arilla *et al*, 2005).

This study aims to investigate the relationship between the atmospheric concentration of Pla a 1 aeroallergen, the *Platanus* pollen and the different air pollutants.





Fig. 4. ELISA plate reader.



Fig. 2. Pollen grains of *Platanus* (OM, x 40).





Fig. 3. A. Hirst-type volumetric trap B. Burkard Cyclone sampler.

Material and Methods

The period of this study includes the *Platanus* main pollen season, from March to June in the years 2009, 2010 and 2011. The pollen sampling was carried out using a Hirst-type volumetric trap (Lanzoni©) for pollen grains (Fig. 3A) and a Burkard Cyclone sampler (Burkard©) for Pla a 1 allergen (Fig. 3B). The pollen samples were prepared and analysed following the procedure recommended by the Spanish Aerobiology Network (Galán *et al.*, 2007). Allergens were quantified by modified ELISA (Fig. 4).

Air pollutant (PM-10, PM-2.5, NO and $NO_{2,}$ carbon monoxide, sulfur dioxide, ozone and bencene) levels have been provided by the Valladolid Air Pollution Control Network.

We have used Spearman's test through the SPSS 14.0 statistical package in order to establish potential correlations between daily pollen and Pla a 1 concentrations and different air pollutants.



Results and Discussion

Platanus pollen is the most abundant pollen in the atmosphere of the city of Valladolid and represents the 39.0%, 29.3% and 30.2% of the total pollen of the years 2009, 2010, 2011, respectively.

During the *Platanus* pollination period, the aerobiological dynamics of *Platanus* pollen grains, Pla a 1, particulate matter (Fig. 5) and nitrogen oxides are quite alike for 2009, 2010 and 2011.

The peak days of proteins and *Platanus* pollen occurred during the first 20 days of April (Table 1).

Positive correlations were found between concentration of *Platanus* pollen and levels of aeroallergens, with a level of significance of 0.01 (Table 2).

Positive correlations are found between Pla a 1 and particulate matter and between Pla a 1 and nitrogen oxides NO and NO₂. Also, negative correlations are found between the aeroallergen and ozone (Table 3).

Platanus	2009	2010	2011
Peak day of Pla a 1	March 27 and April 3	April 20	April 6
Pla a 1 concentration on the peak day	216.27 and 177.73	284.03	751.79
Peak day of pollen Platanus	March 28 and April 4	April 20	April 7
Pollen <i>Platanus</i> grains on the peak day	884 and 1276	605	2460

Table 1. Peak days of proteins Pla a 1 and Platanus pollen.

		Year		Pla a 1
<i>Platanus</i> Pollen		2009	Study period	0,24
			МАР	0.59(*)
	Platanus Pollen 2010 2011	2010	Study period	0.57(**)
			МАР	0.79(**)
		2011	Study period	0.19
		МАР	0.23	
		2009-2011	Study period	0.36(**)
			МАР	0.39(**)

Table 2. Spearman correlation indices among Pla a 1 and *Platanus* pollen, during the period of study of allergen and during the Main Allergenic Period (MAP). Significance level: (*) 0.05, (**) 0.01

		2009	2010	2011	2009-2011
	Study period	0.02	-0.01	0.34(**)	0.12
FIVIIU	MAP	0.23	-0.22	0.23	0.11
DN/0 5	Study period	-0.05	0.15	0.29(*)	0.11
P IVI 2,5	МАР	0,17	-0.21	0.27	0.13
NO	Study period	0.15	0.29(*)	0.48(**)	0.31(**)
NO	MAP	0.15	0.6(*)	0.52(*)	0.32(*)
NO	Study period	0.03	0.26(*)	0.38(**)	0.24(**)
\mathbf{NO}_2	MAP	0.06	0.40	0.43	0.27
\mathbf{CO}	Study Period	0.21	0.10	0.16	0.16(*)
CO	MAP	-0.01	0.16	0.23	0.01
50	Study Period	0.12	-0.08	0.18	0.05
50_2	MAP	0.19	0.59(*)	-0.18	0.16
0	Study Period	0.08	-0.17	-0.51(**)	-0.22(**)
\mathbf{U}_3	MAP	-0.22	-0.54(*)	-0.47	-0.33(*)
СЦ	Study Period	-0.12	0.07	-0.05	-0.03
$C_6 \Pi_6$	МАР	-0.18	0	Variation and	-0.14

Table 3. Spearman correlation indices among Pla a 1 and air pollutants,

Period (MAP). Significance level: (*) 0.05, (**) 0.01.

during the study period of allergen and during the Main Allergenic

Fig. 5. Variations of daily concentrations Pla 1 (pg/m³), *Platanus* pollen (pollen/m³), PM10 and PM2.5 (ug/m³) in Valladolid during the study period.

Conclusions

The higher levels of Pla a 1 are produced with a high concentration of *Platanus* pollen. The first 20 days of April may be considered periods of risk to human health. We observed relationship between Pla a 1 and some pollutants.

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The higher concentrations of Pla a 1 are recorded with decreases in ozone levels, due to its lower oxidative action, which has been shown in studies in vitro (Ribeiro *et al*, 2013).

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