Connections between PM_{10}, pollen and atmospheric pollutants at León (Spain)

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Pollutant gases and particles coexist in the same medium, the atmosphere, with the possibility of interacting with each other and increasing their adverse impacts due to synergistic effects. Focusing on particulate matter, a wide variety of biogenic particles with a broadly open size distribution (from tens of nanometers to a few hundred micrometers) is present in the atmosphere. These biogenic aerosols are very active for diverse potential diseases. Among them, pollen should be highlighted due to allergy effects (Fernández-González *et al.*, 2010). According to Sénéchal *et al.* (2015), atmospheric pollutants may have the following direct effects on pollen: i) increase in their potential health hazards; ii) alteration of the physicochemical characteristics of the pollen surface, iii) change in the allergenic potential, and iv) decrease in viability and germination.

This study aims to investigate the relationship between the atmospheric concentration of pollen and the different air pollutants in the city of León (Spain). With this aim, a monitoring campaign was carried out between 8 and 22 July, 2012 at the university campus of León, Spain (42° 36' 50" N, 5° 33' 38" W, 846 m asl). The city is located in the Northwest of Spain, with a Mediterranean Pluviseasonal-Oceanic bioclimate.

The following instruments were used: i) a Hirst-type volumetric trap VPPS2000 (Lanzoni©) for hourly collection of pollen grains; ii) a Multivial Cyclone Sampler (Burkard©) to collect the aeroallergens; iii) an optical particle counter (PCASP-X) for the continuous monitoring of particle size distributions; iv) a low volume sampler TCR TECORA to collect PM_{10} samples onto pre-baked (6 h at 500 °C) 47 mm diameter quartz filters; v) an IAQ-CALC monitor (model 7545) from TSI for continuous measurements of temperature, relative humidity (RH), CO_2 and CO; vi) Radiello® diffusive passive tubes (cartridge code 165) for VOCs and carbonyls sampling (from Monday to Friday) and vii) diffusion tubes supplied by Gradko for NO_2 sampling (from Monday to Friday). Furthermore, a Davis Weather Station was used for continuously registering the temperature and humidity at the sampling place. Additional data provided by the regional air quality network (http://www.medioambiente.jcyl.es/) related to PM_{10}, O_3, SO_2, maximum and minimum temperature, relative humidity, NO_2 and precipitation were also taken into account.

The gravimetric determination of the PM_{10} mass was carried out under controlled temperature and relative humidity conditions. Each filter was subjected to three different analyses: (1) organic and elemental carbon (OC and EC); (2) carbonates and (3) water-soluble inorganic ions (Na^+, NH_4^+, K^+, Mg^{2+}, Ca^{2+}, Cl^-, NO_3^-, PO_4^{3-} and SO_4^{2-}).

The samples of pollen were prepared and analysed following the procedure recommended by the Spanish Aerobiology Network and the profilin content in extracted samples was quantified using a double antibody sandwich ELISA method.

For pollen analysis, hourly optical microscopic counts were carried out, looking for 63 different taxa. As expected in this period, *Poaceae* and *Castanea* were predominant. The analysis of the Ole e 2 profilin was done by immunochemical technique, and shows that their presence in the atmosphere is scarce or null in this time of year.

The relationship between the different variables was studied, trying to identify the main factors affecting pollen concentration in the atmosphere. This kind of interdisciplinary studies is needed to better understand the complex interactions between plant, atmosphere, soil, and meteorological conditions. In this way, it will help to mitigate the effect of these interactions on health.

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