Time series analysis of airborne pollen from *Quercus* species

I. Silva[1], A. Miró-Morán[2], S. Fernández[3], C. Miró-Rodríguez[2], J.M. Maya[4], A. Gonzalo[5], R. Tormo[4]

[1] Escuela de Ingenierías Agrarias, UEx, Badajoz. [2] Facultad de Veterinaria, UEx, Cáceres. [3] Escuela Politécnica, UEx, Cáceres. [4] Facultad de Ciencias, UEx, Badajoz. [5] Hospital Universitario Infanta Cristina, Badajoz

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Introduction.

Quercus genus includes several tree species of great importance in vegetation in Mediterranean countries. In the SW of Iberian Peninsula are mainly holm oak (*Q. ilex*) and cork oak (*Q. suber*). They pollinate by air essentially in spring and their pollen is captured by aerobiological samplers for at least five months a year. The aim of this work is to analyze annual variation in seasonal airborne pollen capture from this pollen type for 21 years of continuous recording.

Material and Methods.

Daily concentration of airborne pollen concentration were obtained by using a Hirst type pollen trap (Fig. 1) located at the roof of a building at the University of Extremadura in Badajoz (SW Spain). Data were provided in daily pollen grains concentration per cubic meter. Data from the period 1993-2013 were compared using time series analysis. The year with more data (1999) was used as reference to compare the rest of the years.

Results.

Results by cross correlation function showed that the lag-days ranged from -31 to 22. This lag showed a trend (r -0.489, p 0.034) to decrease on average 1.2 day per year (Fig. 2, 3).

At least two peaks in the seasonal pattern were observed in 18 out of 21 cases (Fig. 3). The autocorrelation function showed and average lag of 14.8 days between the first peak and the second, no statistically significant in 6 cases. A third peak was significant in 10 cases, with an average lag of 35 days. Total annual pollen recorded showed a decrease trend in the period studied nevertheless without statistically significance.

Fig. 1. Pollen trap (left) and *Quercus ilex* inflorescence (right).
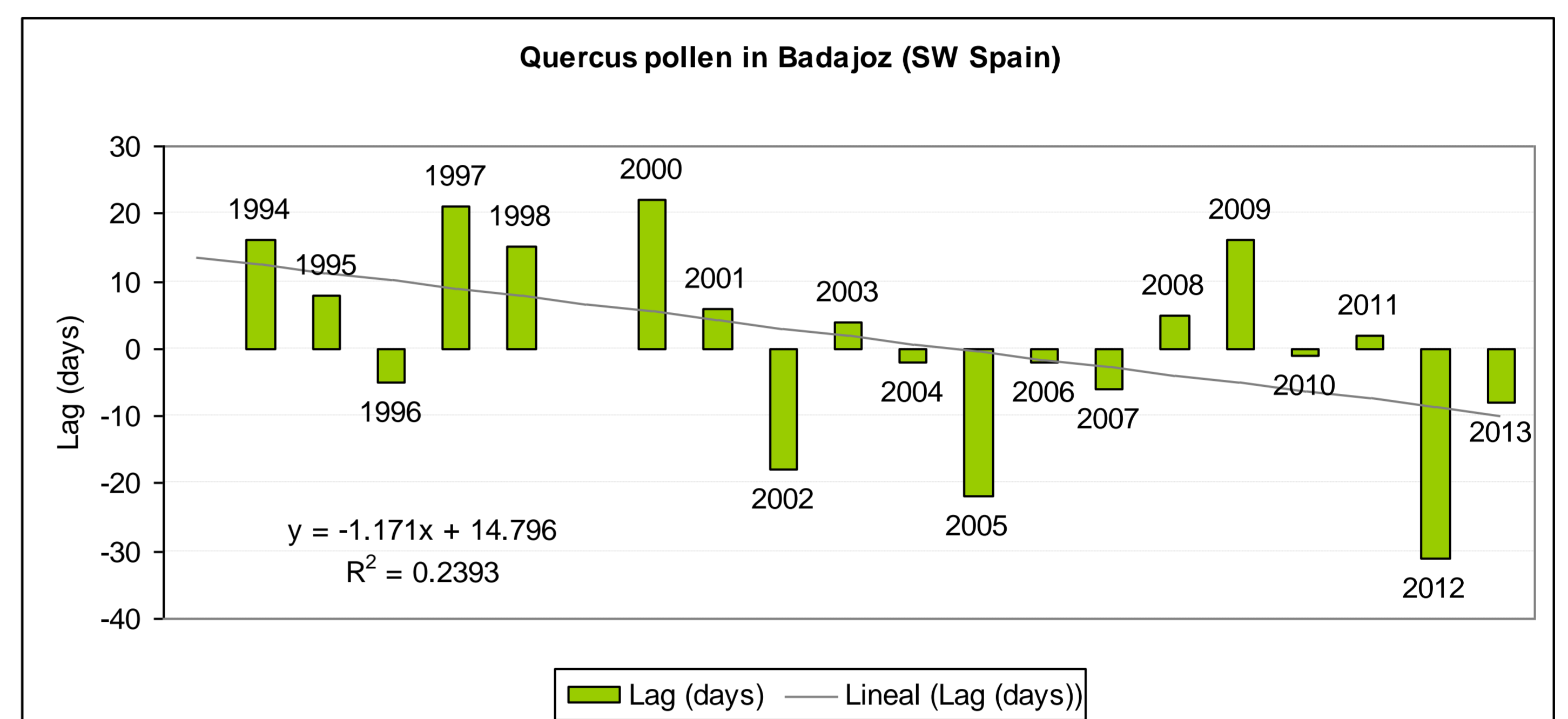
Fig. 2. Cross Correlation Function (First: 1999, Lagged: other year)
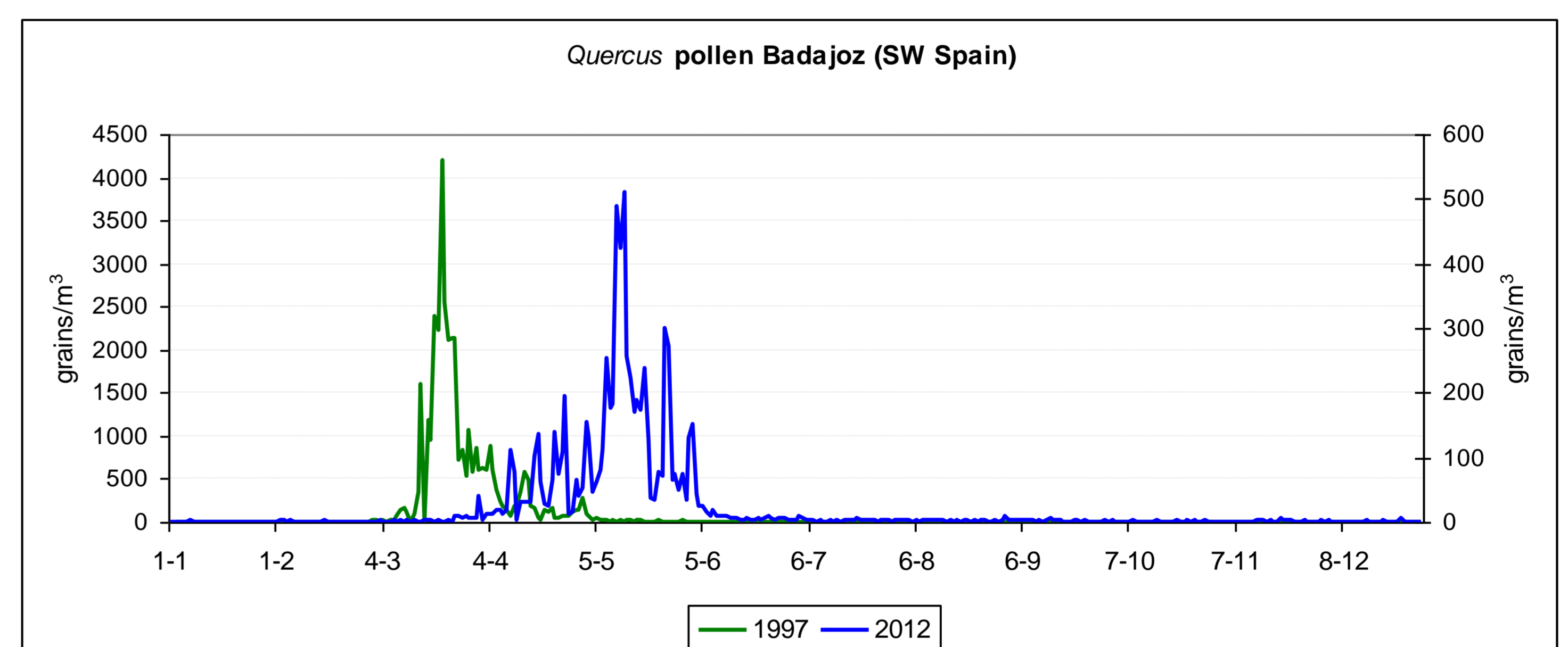
$$y = -1.171x + 14.796$$
$$R^2 = 0.2393$$
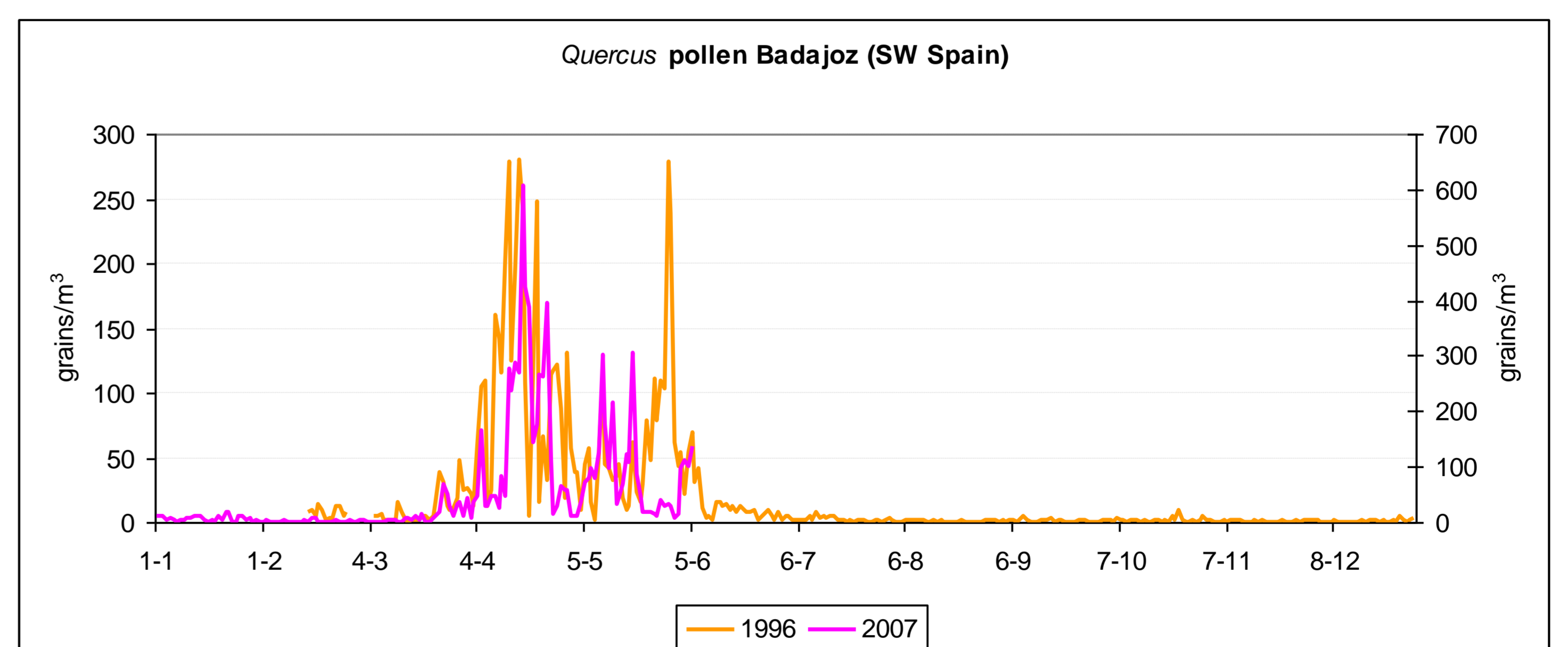

Fig. 3. Daily pollen concentration Quercus pollen in two years

Fig. 4. Daily pollen concentration Quercus pollen in two years

Conclusions.

In conclusion, time series analysis of *Quercus* pollen demonstrated the presence of at least two peaks in daily pollen concentration. Phenological observations allows assign these peaks to the most abundant species, holm oak and cork oak, with an average lag-day of nearly 15 days. The third peak may correspond to other species less abundant or more remote, as *Q. coccifera* and *Q. pyrenaica*, presents in the region. Although trend in total amount of pollen not was observed, the lag trend observed by cross correlation function may be a consequence of global climate change observed in other airborne pollen types.