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Time series analysis of airborne pollen from *Quercus* species

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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.

Daily concentration of airborne pollen concentration were obtained by using a Hirst type pollen trap 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 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. At least two peaks in the seasonal pattern were observed in 18 out of 21 cases. 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.

In conclusion, time series analysis of *Quercus* pollen demonstrated the presence of at least two peaks in daily pollen concentration. Phenological observation permit assign these peaks to the most abundant species, holm oak and cork oak, with an average lay-dag 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.

adfa, p. 1, 2011.

Seasonality of prices in mushroom markets.

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This paper quantifies seasonal effects on mushroom prices and the eventual stationarity of mushroom prices, in one of the main wholesale markets in Spain, over the period 2002 to 2013. Data are obtained weekly, for 13 weeks a year (which gives a total amount of 215 observations).

In the paper the main hypothesis that prices follow a linear stochastic process with a unit root is tested. The intuition behind is that weekly prices for mushrooms depend on prices of the last week. That is, that prices follow a random walk. The random walk is a difference stationary process. So, in the paper we will test if mushroom prices follow a difference stationary series or rather a stationary series.

Graphic analysis of data is complicated and does not permit us to state clearly a hypothesis about the stationarity of prices. Some of the tests which are applied are routinely used in testing for unit roots, but some others are more robust (regarding seasonal time series data).

It is interesting to point out that results from these second tests suggest a completely different behavior for mushroom prices. So, the use of HEGY, ADF--GLS and Ng and Perron tests allow us to sustain the hypothesis that our mushroom prices time series is stationary.

The main consequence from this is that the relevance of past mushroom prices in the formation of current mushroom prices is very weak. Hence, mushroom prices are mainly affected by the existing market and current environmental conditions, and the relevance of past events is very weak. That is, mushroom prices follow a stationary behaviour, and occasional changes in market conditions should not induce to a new equilibrium value.

This statement should be relevant both for professional mushroom producers and policy makers, especially those related to public forest policies.

Keywords: Non-timber forest products; Forest economics; Seasonal time series analysis; Stationarity.