Aerobiologia (2010) 26:89–98
DOI 10.1007/s10453-009-9146-2

ORIGINAL PAPER

High incidence of *Aspergillus* and *Penicillium* spores in the atmosphere of the cave of Nerja (Malaga, southern Spain)

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Received: 8 May 2009 / Accepted: 1 December 2009 / Published online: 20 December 2009

Abstract The cave of Nerja, which is visited annually by more than half a million people, is a karstic cavity situated in the east part of the province of Malaga (southern Spain), with internal conditions of humidity and temperature that make it a space highly conducive to the development of fungus. Fungal spores are of great interest in aerobiology and allergy due to their high incidence in both outdoor and indoor environments and their widely recognized ability to cause respiratory diseases and other pathologies. In this work, we focus on the seasonal and intradiurnal study of the *Aspergillus/Penicillium* spore type (conidia), which is especially abundant in the atmosphere inside the cave of Nerja. This study was carried out over an uninterrupted period of 4 years (2002–2005) with the aid of a Hirst-type volumetric pollen trap (Lanzoni VPPS 2000) situated in one of the halls of the cave. The results show that the spores of *Aspergillus/Penicillium* type represent 48.6% of the annual spore index, June, July and August being the months with the highest rates of these spores, with an average incidence for the 4 years of 11, 63 and 15% of the annual total, respectively. However, the most interesting observation was the sudden increase in the concentration of these spores that occurred during 1 day of the year, when levels might reach nearly 300,000 spores/m^3 of air as daily mean. Finally, it was concluded that these peaks were due to human activities carried out inside the cave, coinciding with celebration of the annual festival of dance and music. On the other hand, the intradiurnal study showed that the highest concentrations are reached between 1200 and 1400 hours. Although there are no standard indices related to the risk of exposure to spore concentrations, we think that the values obtained were high enough to be considered as a potential risk factor capable of producing harmful effects on human health. We therefore recommend taking the necessary measures to prevent such high increases in the spore levels inside the cave.

Keywords Aerobiology · *Aspergillus* spores · Cave · Health risk · *Penicillium* spores

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1 Introduction

The cave of Nerja is a karstic cavity situated 4 km east from the locality of the same name, in the south edge of Sierra Almijara, 70 km east of Malaga, the provincial capital (southern Spain; Fig. 1). One of the