

Occupational exposure to toxigenic *Aspergillus versicolor* in Portuguese swines

Carla Viegas¹; Raquel Sabino²; Susana Viegas¹; Cristina Verissimo²

¹ ESTeSL, Portugal

² INSA Lisbon, Portugal

1. INTRODUCTION

Biological factors associated with airborne dust are the most important hazards in pig buildings and include allergenic and/or toxic compounds, as well as infectious agents such as fungi and their metabolites, like mycotoxins. Inhalation of such agents can be a potential occupational treat (Kim *et al.*, 2008).

Exposure of workers from swine confinement buildings to respiratory hazards has been reported elsewhere in Europe (Portengen *et al.*, 2005; Radon *et al.*, 2002; Simpson *et al.*, 1999), Asia (Kim *et al.*, 2008; Chang *et al.*, 2001) and America (Cormior *et al.*, 1990; Donham, 2000). Analogous data has not been reported for Portugal and this omission has hindered the development of policies in the area of occupational health and farm safety.

Aspergillus versicolor is known as being the major producer of the hepatotoxic and carcinogenic mycotoxin sterigmatocystin. The toxicity of this mycotoxin is manifested primarily in liver and kidney (Engelhart *et al.*, 2002).

This study aimed to determine occupational exposure treat due to fungal contamination caused by *A. versicolor* in seven Portuguese swine.

2. MATERIALS AND METHODS

Air samples were collected with the Millipore Air Tester (Millipore) by impactation method at a velocity of 140 L / minute and at one meter height, using malt extract agar supplemented with chloramphenicol (0.5%). Air sampling was also performed outside premises, since this is the place regarded as reference. Concerning surfaces samples, they were collected by swabbing the surfaces of the same indoor places, using a 10 by 10 cm square stencil disinfected with 70% alcohol solution between samples according to the International Standard ISO 18593 – 2004. The obtained swabs were then plated onto MEA. All the collected samples were incubated at 27 °C for 5 to 7 days.

After laboratory processing and incubation of the collected samples, quantitative (colony forming units/m³ and colony forming units/cm² - CFU/m³ and CFU/cm²) and qualitative results were obtained, with the identification of the isolated fungal species (Hoog *et al.* 2000).

3. RESULTS AND DISCUSSION

Twelve different *Aspergillus* species were identified among the 62 collection points from where *Aspergillus* isolates were collected. In the studied settings, *A. versicolor* presents the highest airborne spore counts (3210 ufc/m³) and the highest overall prevalence (41.9%), followed by *A. flavus* and *A. fumigatus* (8.1%). From the analyzed surfaces, *A. versicolor* was also detected in higher values (>300 cfu/cm²).

Due to their easier detection, fungi are often used as an indirect indicator of mycotoxins presence both in agricultural and occupational settings, and because of that we must consider the eventual exposure not only to fungal particles, but also to the hepatotoxic and carcinogenic mycotoxin sterigmatocystin (Thrane *et al.*, 2004). These mycotoxin is closely related to aflatoxin mycotoxins as a precursor of aflatoxin biosynthesis (Barnes *et al.*, 1994) and is classified as an International Agency for Research on Cancer class 2B carcinogen (i.e., as possibly carcinogenic to humans) (International Agency for Research on Cancer, 1987).

4. CONCLUSIONS

It was possible to characterize the contamination caused by *A. versicolor* in the seven swine units. This study raises the concern of occupational treat due not only to the detected fungal load, but also to the toxigenic potential of these species. Exposure to sterigmatocystin by inhalation of air and dust should be consider a route of exposure in this setting.

5. ACKNOWLEDGMENTS

The study would not have been possible without the assistance of the Portuguese Ministry of Agriculture, Portuguese Ministry of Health and also swines farmers. This work was supported by Portuguese Authority for Work Conditions.

6. REFERENCES

- Barnes, S., Dola, T., Bennett, J. & Bhatnagar, D. (1994). Synthesis of sterigmatocystin on a chemically defined medium by species of *Aspergillus* and *Chaetomium*. *Mycopathologia*, 125,173–178
- Chang, C., Chung, H., Huang, C. & Su, H. Exposure of Workers to Airborne Microorganisms in Open-Air Swine Houses. *Appl Environ Microbiol*, 67(1), 155-161.
- Cormior, Y., Tremblay, G., Meriaux, A., Brochu, G. & Lavoie, J. (1990). Airborne Microbial Content in Two Types of Swine Confinement Buildings in Quebec. *Am Ind Hyg Assoc*, 51(6), 304-309.
- Donham, K. (2000)The concentration of swine production: effects on swine health, productivity, human health, and the environment. *Toxicology*, 16(3), 559-597.
- Engelhart, S., Looek, A., Skutlarek, D., Sagunski, H., Lommel, A., Harald, F. & Exner, M. (2002) Occurrence of Toxigenic *Aspergillus versicolor* Isolates and Sterigmatocystin in Carpet Dust from Damp Indoor Environments. *Applied and Environmental Microbiology*, 68 (8), 3886–3890.

- Hoog, C., Guarro, J., Gené, G. & Figueiras, M. (2000) *Atlas of Clinical Fungi*. (2th ed). Centraalbureau voor Schimmelcultures. International Agency for Research on Cancer. 1987. *Some naturally occurring substances*. Monographs, vol. 10, Suppl. 7, p. 72. International Agency for Research on Cancer, Lyon, France.
- Kim K., Ko H., Kim Y. & Kim C. (2008). Assessment of Korean farmer's exposure level to dust in pig buildings. *Ann Agric Environ Med*, 15, 51-58.
- Portengen, L., Preller, L., Tielen, M., Doekes, G. & Heederik, D. (2005). Endotoxin exposure and atopic sensitization in adult pig farmers. *J Allergy Clin Immunol*, 115, 797-802.
- Radon, K., Danuser, B., Iversen, M., Monso, E., Weber, C., Hartung, J., Donham, K., Palmgren, U. & Nowak, D. (2002). Air Contaminants in Different European Farming Environments. *Ann Agric Environ Med*, 9, 41-48.
- Simpson, J., Mc Niven, R., Pickering, C., Oldham, L., Fletcher, A. & Francis, H. (1999) Comparative Personal Exposures to Organic Dusts and Endotoxin. *Ann Occup Hyg* 1999, 32(1), 107-115.
- Thrane, U., Adler, A., Clasen, P., E., Galvano, F., Langseth, W., Lew, H., Logrieco, A., Nielsen, K.,F. & Ritieni, A. (2004). Diversity in metabolite production by *Fusarium langsethiae*, *Fusarium poae*, and *Fusarium sporotrichioides*. *Int. J. Food Microbiol*, 95,257-266.