GOOD AND EVIL IN THE EXTREME, OR THE CASE OF THE HERPOTRICHIELLACEOUS FUNGI

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The black yeasts is a functional group of fungi that owe its name to their strongly melanized thallus and by an ability to grow either as filaments, budding cells, or by forming meristematic structures. Such physiological flexibility and melanin pigmentation enables them to colonize a wide range of hostile and –sometimes– very unusual environments, so that many species are in fact considered as extremophilic eukaryotic microorganisms (de Hoog *et al*., 1999). Yet, knowledge on the ecophysiology and phylogenetics of these fungi remains far behind that on most genera of ascomycetes. A reason explaining this lag may be the slow growth and low competitive ability of the majority of the species under common laboratory conditions, where they are easily overlooked in routine studies. In addition, black yeasts are notoriously difficult to identify on morphological grounds.

Recent advances on the development of selective isolation techniques and on fungal molecular phylogeny have prompted the description of several new black yeast species, which could then be accurately positioned within the fungal Kingdom (Zhao *et al*., 2010). Black yeasts primarily belong to two clearly delimited orders: the *Dothideales* and the *Chaetothyriales*. Dothidealean species tend to be isolated from the environment in relation to conditions of extreme pH and temperature, high salinity, radiation, desiccation, etc. A very few species are opportunistic human pathogens, but virulence in the group is comparatively low, mostly limited to superficial skin infections. Conversely, the vast majority of the black yeasts isolated from clinical cases of severe deep mycoses belong to the *Chaetothyriales* and, in particular, to the family *Herpotrichiellaceae* (Guarro et *al*., 2000).

One of the most surprising findings of the last few years is the consistent isolation of herpotrichiellaceous fungi from environments that are polluted with aromatic hydrocarbons. The assimilation of toxic aromatics such as toluene and styrene as the sole carbon and energy sources has been demonstrated with different species, and some biotechnological applications in bioremediation have already been devised for these fungi. However, just as the tendency to cause severe infections, the ability to metabolize aromatics appears to be scattered throughout the *Herpotrichiellaceae* (Prenafeta *et al*., 2006). Understanding the interrelations between this two ecological traits and the clear delimitation of pathogenic species is thus fundamental in order to prevent biohazard. Our later findings suggest that herpotrichiellaceous fungi are undergoing a process of strong evolutionary radiation and the occurrence of sibling species that are either evolving towards virulence or to the metabolism or toxic pollutants is not uncommon. This phenomenon is illustrated by the phylogenetically very similar species *Cladophialophora bantiana*, most strongly and consistently associated with brain infections, and the recently described toluene-assimilating *C. psammophila*, which is in fact non virulent at all (Badali *et al*., in press).

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