Microbial deterioration of works of art: An interdisciplinary approach in the Criminology Museum of National & Kapodistrian University of Athens

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INTRODUCTION. In museum and archives' collection environments fungi are a critical artefact biodeterioration factor, whereas most infections are airborne. Poor ventilation and non-homogeneous temperature can produce water condensation points and local micro-climates. These circumstances favour some fungal species activity in specific museum areas. Typical fungal infections in museums, colonizing paper made documents, are caused by species of slow-growing *Ascomycetes* as well as mitosporic xerophilic fungi of the genera *Aspergillus, Penicillium and Cladosporium*. The study was implemented in the exhibits of the Criminology Museum of National & Kapodistrian University of Athens.

MATERIALS AND METHODS

In this study a non-invasive diagnostic method of biodeterioration in selected paper artefacts was explored, using for this purpose contact plate sampling.

Growth medium deployed during the experimental growth trials was Sabouraud Dextrose Agar W/Chloramphenicol & Actidione (SDA agar in petri dishes 6 cm ready for use, BIOPREPARE). After sampling, the materials were incubated at 25° C. Colonization progress monitoring was carried out throughout the experiment at 5,7,12,15,20 days, while the morphological characteristics of the colonies were recorded. A Leica DM 2700 M optical microscope coupled with a DC 300F camera was used for the observation in dark field conditions (DF).

RESULTS

Two fungal species belonging to different genera were isolated from indoor environments. More specific, *Penicillium* and *Aspergillus niger* appear to be the dominant fungus with the maximum number of colonies growing on the SDA medium. The sample from the inside page of the magazine (**Fig.1B**) gave negative results. **Figure 2 (A, B, C, D, E, F)** demonstrate the gradual growth characteristics registered after 12 days of incubation at 25°C for samples taken from the front pages (**Fig.1A**). The fungus identified is of the genus ***Penicillium***. The species cannot be characterized because the colonies that form the fungus resemble each other. **Figure 2 (G, H, I, K , L,M)** show the gradual growth characteristics after 5 days incubation at 25°C for samples taken from the back pages (**Fig.1C**), highlighting black mould pathogen ***Aspergillus niger*** characteristic fungal development on SDA medium.

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REFERENCES AND NOTES

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SAMPLING. Contact plating is the most appropriate method for monitoring artefacts microbiological surface contamination by rendering the microbial load on surfaces visible. The SDA agar surface was pressed against the test surface for a short contact time. In this manner, part of the fungi and mold colonizing the surface was transferred to the agar surface (**Fig.1 A** and **B**). After subsequent incubation, the growing colonies indicate the level and type of microbial load on the artefact. **Fig.1C** illustrates the sampling area used. The paper sample was easily removed from the page and placed on the surface of the agar by using forceps for this purpose.

Figure 1: *Non-invasive sampling and transfer of surface microbial load from documents belonging to the Printed Material Collection (indoor) of the Criminology Museum of National & Kapodistrian University of Athens*

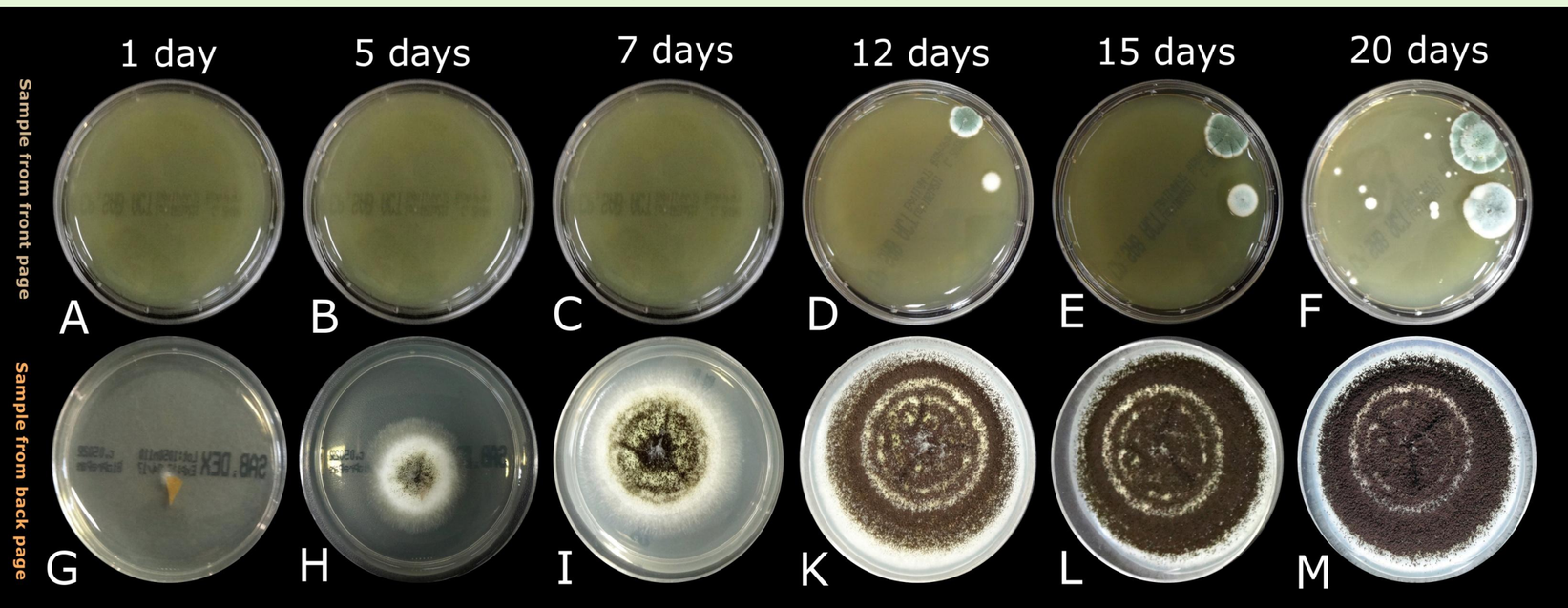

Figure 2: *Contact plating and monitoring of microbial colonisation progress at 5, 7, 12, 15, 20 day incubation time intervals for surface samples taken from the front (A,B,C,D,E,F) and back (G,H,I,K,L,M) pages of documents*

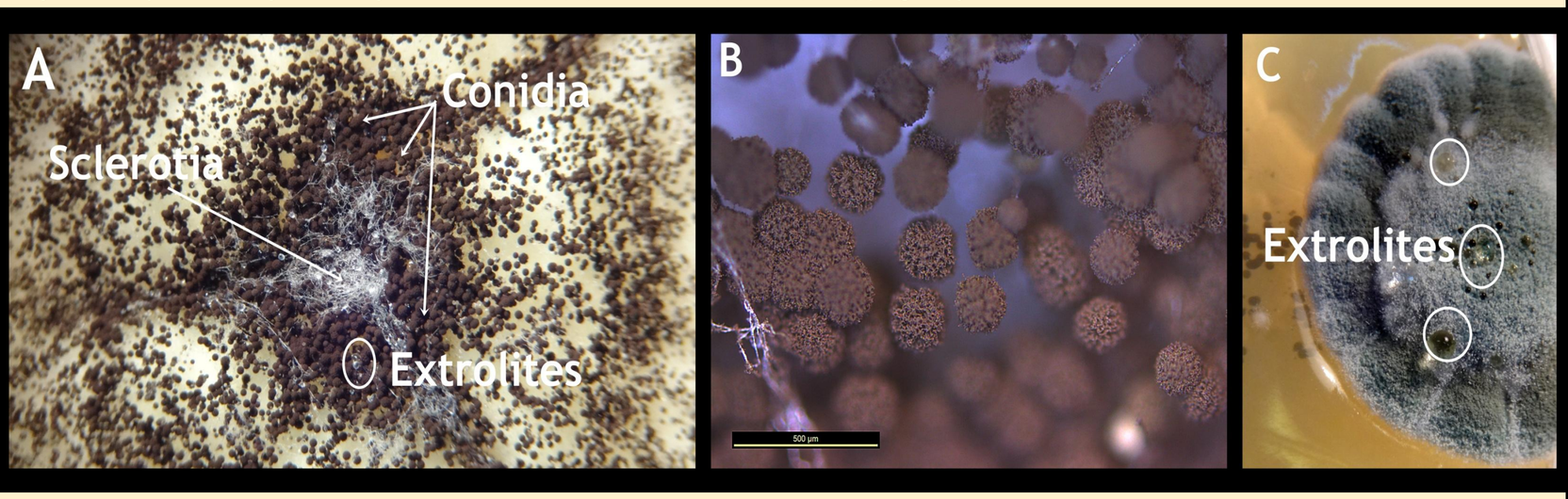

Figure 3: *Type and morphology of surface microbial load colonies. A: Aspergillus niger, magnification 7x,(Detail from colonies in petri dish Fig.2K).During the growth of the fungus, the colony becomes black due to conidia production. Observed the droplets of the exudate (extrolites).B:Microscopic morphology of Aspergillus niger showing large, globose, dark brown conidial heads, which become radiate, magnification:5x DF. C: Extrolites from Penicillium, magnification:7x,(Detail from colonies in petri dish Fig.2F).*

CONCLUSIONS: The overall success of the interdisciplinary research approach followed in this work, clearly demonstrates the feasibility of newly founded synergies of different scientific and research fields towards the knowledge-based optimization of museum collection care.