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Title: Evaluating the antimicrobial activity of essential oils in the conservation of mural paintings

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Abstract

One bacterial species and five fungi were isolated from the mural paintings of the

Egyptian tomb of Khety (Tomb No. 17, 11th Dyn.). The antimicrobial activity of lemon and thyme essential oils (EOs) diluted in ethanol 70% was evaluated against the bacterial isolate (related to the genus *Alcaligenes* and the species *faecalis* identified using 16S rRNA gene sequencing) and the most predominant fungi in the tomb, *Aspergillus niger*, *Penicillium cyclopium* and *Fusarium Solani* on agar plates using the disc diffusion method. Fragments were taken from the mural painting layers for analysis and examination to prepare replicas (5×5cm) similar to the archaeological mural painting and were artificially aged. Antimicrobial activity of the two studied EOs was evaluated against the bacterial isolate and the three studied fungi on replicas. Interestingly, our results revealed that the thyme oil at a concentration of 15% is generally more efficient than lemon EO against the three studied fungi and, in contrast, the lemon oil was more efficient against the bacterium than fungi. Moreover, colorimetric measurements

proved that no notable changes occurred to the replica after treatment with the two tested EOs in 10% and 15%. From the GC-MS analysis, the volatile profile of the lemon oil revealed that it is mainly composed of monoterpenes, with citral, 6-exohydroxy camphene, and Fenchone as the major compounds. Our results showed that thymol (44.38%) is the major compound for the thyme oil.

Keywords:

fungi, bacteria, mural painting, essential oils, analytical technologies