

<i>Trichoderma</i> spp. In Cultural Heritage Mural Paintings of Ancient Egyptian Tomb, Their Antifungal and Bioactivity	عنوان البحث باللغة الانجليزية
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Abstract:

Trichoderma spp. was isolated from the mural paintings surfaces of the tomb of Nefer-Bau-Betah, This tomb was previously deteriorated in 2007 by *Aspergillus niger*, *A. flavus*, and *Alternaria alternata* but in 2019, the tomb was deteriorated by only *A. niger*, and *Trichoderma* species were isolated -that were not isolated before in 2007. Three species of *Trichoderma* were identified according to their bioactivity effect on these microorganisms and by their sequences in the GenBank to *Trichoderma harzianum*, *T. hamatum*, and *T. aureoviride*. Furthermore, mural paintings in the burial chamber were characterized by EDX analysis which presented that the ground layer consisted of Quartz, Calcite and Gypsum, while the pigments were characterized as Egyptian green, Egyptian blue, and Hematite (Fe_2O_3). The binding media was Egg yolk according to the spectrum of Raman spectroscopy. The pigments were assayed by the spectrophotometer but it caused a little effect in the color change of the pigment inside the tomb especially the Blue and green Egyptian pigments, while it caused a less effect in the color change of red Hematite pigment. The optimization factors for increasing the bioactivity of the *Trichoderma* spp. were 5% of sodium nitrate and sodium chlorine that crystallize in the tomb, average temperature between 30:35°C in acidic pH (pH=5.5). These conditions helped *Trichoderma* species to grow and work as antifungal factors in the tomb *A. niger*, *A. flavus*, and *Alternaria alternate*. *Trichoderma* spp. can be used as a new methodology for controlling the deterioration of cultural heritage, it is an eco-friendly methodology, risk-free when controlling the color change, and easy to apply anywhere vivo or vitro in cultural heritage open doors or in the museums.