Interplay of heavy metals and salinity effects on *Fusarium oxysporum* f. sp. *lycopersici* (FOL) *in vitro* growth and subsequent tomato responses

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ABSTRACT

Tomato plant (*Solanum lycopersicum* L.) is one of the most important and economically significant crops in various countries around the world, including Iraq. However, production rates per unit area remain below desired levels due to biotic stressors, such as pathogens; most notably vascular wilt caused by the fungus *Fusarium oxysporum* f. sp. *lycopersici* (FOL), as well as abiotic factors. Iraq has experienced an unprecedented rise in heavy metal levels, alongside increased soil salinity. Therefore, this study aimed to investigate the effects of interactions between pathogenic FOL, heavy metals, and salinity on the susceptibility of tomato plants to vascular wilt disease.

Statistical analysis results revealed the ability of the pathogenic fungal isolate to tolerate heavy metal concentrations, particularly chromium (298 mg/kg), cobalt (135 mg/kg), and cadmium (16 mg/kg), while lead (228 mg/kg) showed a moderate effect on the physiological growth indicators of the fungus (Radial growth; sporulation and dry growth inhibition). Results also indicated no significant impact of the studied salinity levels (4, 8 and 12 $ds.m^{-1}$) on the fungal growth metrics. In contrast, heavy metals and salinity demonstrated a statistically significant negative effect on seed germination in the Yassamine tomato variety, with a marked decline in germination indices. Furthermore, heavy metals and salinity were found to increase the susceptibility of tomato plants to vascular wilt infection, as disease severity rates rose significantly in treatments combining these factors with the pathogenic fungus. This interplay highlights the critical need to manage soil contaminants and salinity in tomato cultivation to mitigate Fusarium wilt outbreaks.

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