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Effect of polyamines and zeolites on the protein profile of leaves of the date palm cuttings *Phoenix dactylifera* L. grown under heavy metal stress conditions

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This study was conducted on the five to six years old offshoots of date palm (Jebjab) cultivar planted in sustainable land, using an environment contaminated with heavy elements, with irrigation water contaminated with heavy elements $Pb(NO_3)_2$ 300 $mg.kg^{-1}$ and cadmium chloride $CdCl_2$ 3 mmol, as well as the comparison treatment. Then the treatment was with some polyamine compounds Putrescine 500 mg L^{-1}, coumaric acid 500 mg L^{-1}, and a zeolite compound at a rate of 10 kg $Palm^{-1}$, in addition to the comparison treatment in the form of ground addition to the soil of the off shoots samples were taken from palm fronds, samples were dried using Freeze-dryer (Lyophilization technique), the protein was extracted from samples, and protein migration was carried out on Polyacrylamide gel using Slab-Electrophoresis method in the presence of SDS denaturants. The molecular weights of proteins were estimated and plotted using PhotoCapt Mw. The results of the study showed that the protein pattern of the leaves show up that all the trees of the study had taken part (identical) with the first protein bundle and the fifth protein bundle on the polyacrylamide gel, as the molecular weights of the proteins of the first bundle ranged between (222.136-243.750) kDa, while the molecular weights of the proteins of the bundle ranged. The fifth is between (24.843-50.386) kDa. This coincidence or participation in the molecular weights of the protein bundles of all the study trees may indicate that these trees belong to one plant origin (which is the Jebjab variety), as these plants share close molecular weights.
Keywords: Date Palm, molecular weights, polyacrylamide gel, polyamine compounds.

INTRODUCTION

The date palm *Phoenix dactylifera. L* belongs to the palm family Arecaceae. This family includes more than 4000 species and nearly 200 genera (Al-Jubouri,2002). The date palm is one of the most important evergreen fruit trees in several countries of the world. Iraq and the Arabian Gulf region are believed to be its original home. It is possible that it originated in southern Iraq. Since ancient times, Iraq was known for palm cultivation, production, and marketing of dates in the world (Bhat AL-Daihan, 2012; Rasheed and AL-Badri, 2018). Date palm trees in Iraq have been subjected to a significant decrease in their production levels and a severe shortage in their numbers during the past two decades (Central Statistical Organization, 2021).

Pollution is defined as any undesirable change in the physical, chemical, or vital properties of the environment (air, water, and soil), which occurs as a result of pollution-causing substances called pollutants, which are any solid, liquid, or gaseous substance found in certain concentrations that are transmitted from different sources and in different quantities (Bhatia, 2009; Al-Wahaibi, 2007). The toxicity of heavy elements has become one of the important and dangerous phenomena and has harmful effects on the morphological form and the decrease in the rate of photosynthesis in the plant due to the closure of stomata as a result of the deposition of elements and the inhibition of enzymatic activities and an imbalance in the water balance as well as affecting the permeability of cell membranes in addition to causing a disturbance in the absorption of nutrients (Kabir *et al.*, 2010). Heavy elements such as lead and cadmium are among the most dangerous elements that pollute soil and water, and the presence of these elements in the soil leads to a decrease in leaf area and a decrease in chlorophyll production, which leads to inhibition in the photosynthesis process and then a decrease in carbohydrates (Singh *et al.*, 2011, Aljaberi, *et al.*,

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