



**EFFECT OF POLYAMINE COMPOUNDS ON
GROWTH, YIELD AND ITS QUALITY, AND
ANTIOXIDATIVE DEFENSE SYSTEM OF
WHEAT PLANTS GROWN UNDER HEAVY
METALS STRESS CONDITIONS**

By

Safia Mahmoud Abd El-Mgeed Ahmed

A thesis submitted in partial fulfillment

Of

The requirements for the degree of

Doctor of Philosophy

In

Agricultural Science

(Plant Physiology)

Department of Botany

Faculty of Agriculture, Fayoum

FAYOUM UNIVERSITY

2017

ABSTRACT

Two pot experiments were conducted during the two successive seasons of 2013/2014 and 2014/2015 at the Experimental Farm of the Faculty of Agriculture, Fayoum University, Fayoum, Egypt. The aim of this study was to evaluate the beneficial effects of grain soaking or foliar spray using spermine (Spm; 0.25 mM), spermidine (Spd; 0.5 mM) or putrescine (Put; 1 mM) on heavy metal-tolerance in wheat plants (*Triticum aestivum* L., cv. Sakha 94) irrigated with water contaminated by cadmium (CdCl_2 ; 2 mM) or lead (PbCl_2 ; 2 mM). The effects on growth and yield characteristics, concentrations of osmoprotectants, endogenous Cd^{2+} and Pb^{2+} , mineral nutrients and nucleic acids, and antioxidative defense system activity and tissue health in wheat plants were assessed. Under each of the three applied polyamines (PAs) applications, the efficiency of wheat plants to tolerate Cd^{2+} or Pb^{2+} stress in terms of growth and yield characteristics was noticed to varying degrees. The enhancements in osmoprotectant concentrations and plant health [in terms of relative water content (RWC) and membrane stability index (MSI)], and reductions in electrolyte leakage (EL) and endogenous Cd^{2+} and Pb^{2+} concentrations were correlated with the reasonable growth of Cd^{2+} or Pb^{2+} -stressed plants and their grain yield and its quality. Results pointed out also that, better growth and yield characteristics, MSI%, RWC%, leaf photosynthetic pigments concentrations, activities of antioxidant enzymes, osmoprotectant (i.e., proline, total soluble sugars) and nucleic acids concentrations, nutrient contents and tolerance index were obtained with seed soaking in each of the three PAs than those generated with seed soaking in water under

2.0 mM Cd²⁺ or Pb²⁺ stress. In contrast, EL%, concentrations of endogenous Cd²⁺ or Pb²⁺ and hydrogen peroxide, injury index, 1, 1- diphenyl-2-picrylhydrazyl (DPPH) and reducing power were significantly reduced. However, the Cd²⁺ or Pb²⁺-free control plants was exceeded the all stressed treatments and the economic grain yield was negatively correlated with Cd or Pb stress. These results are important as the potential of Spd or Put used for seed soaking to alleviate the harmful effects of Cd²⁺ or Pb²⁺ stress offer an opportunity to increase the resistance of wheat plants to growth under Cd or Pb stress conditions.