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Genotypic Differences in Some Physiological and Biochemical Parameters Symptomatic for Nickel (Ni) Induced Stress in Groundnut (*Arachis hypogaea L.*)

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Abstract

An excess concentration of nickel (Ni) in soil significantly affects the growth and yields of crop plants. Physiological functions and antioxidative enzyme status of the plants are also altered by this stress. The present study aimed to evaluate nickel induced physiological and biochemical changes in a set of thirteen groundnut genotypes to identify the nickel tolerant genotype. Accumulation of free proline and the activities of Catalase (CAT) and Ascorbate Peroxidase (APX) significantly increased in Ni treated plants. Our results indicate that all the genotypes were differing in their growth parameters, concentrations of free proline, electrolyte leakage and antioxidative enzymes. Ni sensitive genotypes correlated with decrease in shoot: root ratio, increase in electrolyte leakage and decrease in antioxidative enzymes. In contrary tolerant genotypes showed better shoot: root ratios, high free proline content, less electrolyte leakage, optimum CAT and APX activities. The study leads in grouping the genotypes into three categories, i.e. tolerant genotypes- Abhaya, Anantha, Greeshma, ICGV-91114 and Dharani; moderately tolerant- K-1375, K-6 and TG-47 and sensitive genotypes- JL-24, Narayani, Prasuna, Rohini and TPT-4 for Ni induced stress.

Key words: Nickel (Ni), proline, Anti oxidative Enzymes – Catalase (CAT), Ascorbate Peroxidase (APX), Ion leakage.

Introduction

Heavy metals enter to the biosphere through natural weathering process (1). A number of the heavy metals are essential for growth and development of the plants. Limited quantities of heavy metals are non toxic to plants, but when exceeding them critical concentrations, these metals become more toxic to the plants. They enter and accumulate in various organs of the plants through the root system of plants (2, 3). Heavy metals affect the plants in two ways. Firstly, they alter plant metabolism by influencing the reaction rates and kinetic properties of enzymes. Secondly, they increase the generation of reactive oxygen species (ROS). In response to metal stress plant develop resistant mechanism to avoid or tolerance to the mental stress (4).

Nickel (Ni) is an essential micronutrient for plants in small quantities (5) and increased levels in soil lead to crop yield loss and human health hazards (6). Random urbanization and other human activities like mining, burning of coal, oil, phosphate fertilizers and pesticides have contributed to a significant increase of soil Ni