OFFICIAL ABSTRACT and CERTIFICATION

Genetic and phenotypic comparison of four Arabidopsis thaliana strains when exposed to heavy metals, for future applications in agriculture

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This study reports the resistance to chromium sulfate (Cr2(SO4)3), nickel sulfate (NiSO4) and copper sulfate (CuSO4) in the Col-0, Lov-1, Ws-2 and Santa Clara strains of Arabidopsis thaliana. Previous reports have shown illness-associated with consuming food grown in environments contaminated with such heavy metals (Shams, et al., 2018). Plant growth and biomass are also affected by considerable amounts of heavy metals in soil. To investigate the effects of heavy metals on Arabidopsis thaliana, plants were exposed to the heavy metals every two days, after 14 days of growth under normal conditions. Plant height was tallied daily and spectrophotometry was performed. BLAST was conducted to locate characteric similarities/differences between the genome sequences of the strains. Based on phenotypic observations, copper, nickel and chromium sulfate were found to have no significant effect on the plants, in comparison with the control. Interestingly, WS-2 exhibited excessive growth when exposed to nickel sulfate, reaching 125mm on Day 25. Only after exposing the plants to the heavy metals for the fourth time, plants exhibited wilting and leaf browning. However, statistical analysis [p result = 0.048 (<0.05)] indicated that only Col-0 was resistant to nickel sulfate. Significant differences in nucleotide strings of Col-0 include inner membrane localized protein, HD Zip, FRO gene family, beta-1,3-n-acetylglucosaminyltransferase radical fringe and SAT gene. The elucidation of a heavy metal-resistant gene in Arabidopsis thaliana could potentially lead to genetic engineering of genes to cultivate heavy metal resistant plants that are safe for human and animal ingestion.

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