Response of *Pisum sativum* L. to Southern Blight Disease under Abiotic Stress of Copper

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Abstract

Food contamination problems due to biotic and abiotic stresses are important issue of the modern word. The current work was performed to investigate the influence of southern blight diseases on germination and growth rate of pea (*Pisum sativum* L.) grown under abiotic stress of Cu(II). Experiment were conducted in plastic pots of 12 cm x 12 cm (diameter x depth) filled with sterilize soil inoculated with *Sclerotium rolfsii* (spore suspension 4.8 x 10^6) in 5 Kg of soil. Metal was applied @ 25 mgL^{-1}, 50 mgL^{-1}, 75 $mgL^{-1}$and 100 mgL^{-1} in 5 kg of soil. Important growth parameters were recorded at 30 d, 60 d and 90 d old seedlings. Results revealed, germination and different growth parameters were declined by 10-70% in treatments inoculated with pathogen followed by parallel reduction of~10-50% either due to effect of metal alone or combined with pathogen. Plants infected with pathogen demonstrated wilting, chlorosis, wrinkling of lower leaves, and rotting of stem and roots near the soil line. The Cu uptake tendency was detected in order of: soil > root > shoots at 30 d, whereas the order was soil > root > pods ≥ shoots at 90 d. Plant under metal stress alone exhibited chlorosis, short internodes, stunt root, no root hair at higher dose of Cu(II). FTIR spectra of soil, shoot and roots before and after exposure to any treatment showed a reorganization of functional groups after metal-bindings within the polysaccharide fingerprint region. The expression of two genes i.e. metallothionine (MTA) and defensin like gene (Def) were checked thorough PCR techniques. Plants under pathogenic conditions showed higher expression of Def than MTA vice versa was observed in Cu-stressed plants. When treatments were kept under simultaneous stress of *S. rolfsii* + Cu, expression of Def like gene was more intense than Def expression in plants grown under pathogenic stress alone. The Cu-responsive genes showed some notable features, as expression of MTA gene was noticed only at higher doses (75 and 100 mg/L) of Cu(II) combined with *S. rolfsii*, as compared to simultaneous MTA expression with increasing concentration (20 to 100 mg/L) in plant under metal stress alone. It can be concluded that copper in irrigation water and Cu-based pesticides can result in land degradation that in turn affects food safety and crop production.