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Green synthesized bi-metallic nanoparticles: A new sustainable approach for controlling charcoal rot of maize

Akhtar S

Minhaj University, Pakistan

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Abstract

Maize lines third largest and edible crop after wheat and rice, and widely cultivated all over the world. Unfortunately, in Pakistan maize yield is very low as compared to worldwide production. There are many biotic and abiotic factors which hampered the maize production. One of the destructive biotic factors is charcoal rot disease (*Macrophomina phaseolina)* (Tussi*)* Goid. In the current research work impact of selenium-zinc oxide doped nanoparticles (Se-ZnO-NPs) was studied on the growth of maize plant grown under the stress of charcoal rot disease after 45 days of germination. Different growth parameters such as shoot and root length and biomass were studied after 45 days of germination Moreover, various physiological attributes such as total chlorophyll content(THC) and reducing sugar (SUG) were studied while biochemical traits i-e total protein content (TPC) catalase (CAT) and polyphenol oxidase (PPO) were studied after 45 days of germination. selenium-zinc oxide doped nanoparticles (Se-ZnO-NPs) were synthesized by using the extract of rhizobium of *Curcuma longa*.Furthermore the successfully prepared Se- ZnO-NPs were characterized for various *in vitro* parameters including FTIR, ICP-MS, particles size, PDI and zetapotential. The ICP-MS reveled 54.43 mg L^{-1} and 71.70 mg L^{-1} Se and Zn ions respectively. SEM analysis revealed the size of prepared Se-ZnO-NPs 37 nm with polyhedral morphology. The EDX spectra also confirmed the presence of Se and Zn in Se-ZnO-NPs The results revealed that soil amended with various concentrations (2, 4, 6, 8 and 10%) of NPs significantly ($p < 0.05$) enhanced the growth of maize plant as compared to respective positive control. The antifungal activity of the prepared Se-ZnO-NPs against *M. phaseolina* exhibited significant ($p < 0.05$) reduction in growth. Thus, the results suggested that green synthesized Se-ZnO-NPs could be used to combat charcoal rot pathogen. However, further field experiments are required to study the activity of doped NPs in soil against pathogens.

Biography

Akhtar S has completed her Ph.D in December, 2016. She is the Assistant professor in School of Botany, Minhaj University, Lahore, Pakistan. She has over 22 international and national publications with 21 impact factor that have been cited more than 50 times.

drsundusiags@gmail.com

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