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TOXIC EFFECTS OF HEAVY METALS (Cu, Zn, Pb, Cd) ON EARLY GROWTH OF THREE *Tagetes* SPECIES

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Heavy metals in soil pose potential threats to the environment; therefore remediation of heavy metal contaminated sites is an important issue. *Tagetes* species have been proposed as potential plants for phytoremediation of heavy metal contaminated soil. Although much research has been carried out previously to investigate the bioaccumulation ability of *Tagetes* species, little information is available on the toxicity of metals on these plants. In our study a seed germination test was conducted to measure the toxic effects of four heavy metals (Cu, Zn, Pb and Cd) on early growth of three different *Tagetes* species (*Tagetes erecta, Tagetes patula* and *Tagetes tenuifolia*). Our results showed that all tested heavy metals had significant ($p<0.05$) toxic effects on seed germination and root/shoot elongation of the three plants. On the basis of IC_{50} values (concentration of a heavy metal which causes 50% inhibition) the following series of phytotoxicity was observed: Cd>Cu>Zn>Pb. *Tagetes tenuifolia* was the most sensitive plant to heavy metals, while *Tagetes erecta* and *Tagetes patula* were able to tolerate low concentration of metals (below 400 mg l^{-1} Cu, Zn, Pb, and below 16 mg l^{-1} Cd) without considerable decline in the measured growth parameters. However, our experiment was carried out under laboratory conditions, and the seeds were germinated in hydroponic solution, which means that these values could be much higher in natural soils. Our results indicate that *Tagetes erecta* and *Tagetes patula* could be suitable for remediating moderately heavy metal (Cu, Zn, Pb and Cd) contaminated soils. With the advantage that these plants can also beautify the environment, using them for phytoremediation has an important and practical significance.

Keywords: *heavy metals, phytotoxicity, Tagetes species, phytoremediation*

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