

EDTA Enhanced Plant Growth, Antioxidant Defense System, and Phytoextraction of Copper by Brassica napus L.

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Abstract : Copper (Cu) is an essential micronutrient for normal plant growth and development, but in excess, it is also toxic to plants. The present study investigated the influence of ethylenediaminetetraacetic acid (EDTA) in enhancing Cu uptake and tolerance as well as the morphological and physiological responses of Brassica napus L. seedlings under Cu stress. Four-week-old seedlings were transferred to hydroponics containing Hoagland's nutrient solution. After 2 weeks of transplanting, three levels (0, 50, and 100 μ M) of Cu were applied with or without application of 2.5 mM EDTA and plants were further grown for 8 weeks in culture media. Results showed that Cu alone significantly decreased plant growth, biomass, photosynthetic pigments, and gas exchange characteristics. Cu stress also reduced the activities of antioxidants, such as superoxide dismutase (SOD), peroxidase (POD), ascorbate peroxidase (APX), and catalase (CAT) along with protein contents. Cu toxicity increased the concentration of reactive oxygen species (ROS) as indicated by the increased production of malondialdehyde (MDA) and hydrogen peroxide (H₂O₂) in both leaves and roots. The application of EDTA significantly alleviated Cu-induced toxic effects in B. napus, showing remarkable improvement in all these parameters. EDTA amendment increased the activity of antioxidant enzymes by decreasing the concentrations of MDA and H₂O₂ both in leaves and roots of B. napus. Although, EDTA amendment with Cu significantly increased Cu uptake in roots, stems, and leaves in decreasing order of concentration but increased the growth, photosynthetic parameters, and antioxidant enzymes. These results showed that the application of EDTA can be a useful strategy for phytoextraction of Cu by B. napus from contaminated soils.

Keywords : antioxidants, biomass, copper, EDTA, phytoextraction, tolerance

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