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Glutathione (GSH) Mediated Protective Mechanisms Alleviate Cadmium Toxicity in *Brassica* Revealed by a Gel-Free Proteomic Approach

Probir Kumar Mitra¹, Swapan Kumar Roy², Md Atikur Rahman³, Soo-Jeong Kwon¹, Sung-Hyun Yun¹, Min-Young Park¹, Sun-Hee Woo^{1*}

¹Department of Crop Science, Chungbuk National University, Cheongju 28644, Korea

²College of Agricultural Sciences, IUBAT– International University of Business Agriculture and Technology, 4 Embankment Drive Road, Sector 10 Uttara Model Town, Dhaka 1230, Bangladesh

³Grassland and Forage Division, Rural Development Administration, National Institute of Animal Science, Cheonan 31000, Korea

[Introduction]

Cadmium (Cd) is a significant environmental hazard because it gathers in plants from the soil and is then transferred into the food chain, posing a serious threat. This is a type of toxic metal that is nonessential and very harmful to both humans and animals. Cd has a significant capacity for accumulating in plants, which makes it useful for phytoremediation of Cd-polluted soil. Glutathione (GSH) is important for reducing the harmful effects of Cd stress on plants. Previous studies have shown that GSH enhances the ability of plants to remediate various heavy metals and counteracts oxidative stress induced by these metals. This study aims to investigate the ability of GSH to retain Cd in plant roots and to evaluate its effects on the growth and physiology of Cd-stressed *Brassica napus* seedlings.

[Materials and Methods]

Healthy seeds of *B. napus* L. were sterilized and placed in petri dishes containing two layers of filter papers and germinated in controlled conditions. Following germination, the morphologically uniform seedlings were transferred to plastic pots and hydroponically grown for 7-days containing Hoagland solution. After one weeks of transplanting, uniform plants were treated with CdCl₂ and Glutathione as T1: Control, T2: Cd (30 μM), T3: Cd (30 μM) + GSH (0.5 mM), and T4: GSH (0.5 mM) with three replications. The control plants were free from CdCl₂ and GSH.

[Results and Discussion]

The research was focused on studying the effects of revealing Brassica plants to CdCl₂. The metal ion, Cd affected growth parameters and caused morpho-physiological alterations. *Brassica napus* seedlings exposed to CdCl₂ for 7 days did not show any leaf chlorosis or withering symptoms. However, Cd stress significantly affects the plant growth characters and plants become yellowish in GSH treated plants. A considerable reduction in the shoot and root growth was observed compared with the control in GSH treated plants. The most significant growth inhibition was observed when plants are treated with CdCl₂ (30 μM). The plant height (Both shoot length and root length) exhibited the largest reduction (15.30 cm in GSH treated plants) compared to control plants respectively. The reduction of shoot and root growth may be occurred due to metal uptake primarily through roots. Based on previous studies, it has been found that the Cd (cadmium) element is stored in the roots of plants when treated with GSH (glutathione), which could potentially be an environmentally friendly and promising method for reducing the concentration of Cd in the edible parts of plants. This could help decrease the health risks posed to both humans and animals.

*Corresponding author: Tel. +82-43-261-2515 E-mail. shwoo@chungbuk.ac.kr