Morphological and Physiological Indicators and Transcriptome Analyses Reveal the Mechanism of Selenium Multilevel Mitigation of Cadmium Damage in *Brassica juncea*

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**Abstract:** Cadmium (Cd) is a common agricultural soil pollutant, which does serious harm to the environment and the human body. In this study, *Brassica juncea* was treated with different concentrations of CdCl2 and Na2SeO3. Then, physiological indexes and transcriptome were measured to reveal the mechanisms by which Se reduces the inhibition and toxicity of Cd in *B. juncea*. The results showed that Se alleviated the inhibitive Cd effects on seedling biomass, root length, and chlorophyll, and promoted the adsorption of Cd by pectin and lignin in the root cell wall (CW). Se also alleviated the oxidative stress induced by Cd, and reduced the content of MDA in cells. As a result, SeCys and SeMet alleviated the transport of Cd to the shoots. Transcriptome data showed that the bivalent cation transporter MPP and ABCC subfamily participated in the separation of Cd in vacuoles, CAL1 was related to the chelation of Cd in the cytoplasm of cells, and ZIP transporter 4 reduced the transport of Cd to the shoots. These results indicated that Se alleviated the damage of Cd in plants and decreased its transport to the shoots by improving the antioxidant system, enhancing the ability of the CW to adsorb Cd, reducing the activity of Cd transporters, and chelating Cd.

**Keywords**: selenomethionine; selenocysteine; cell wall; pectin; bivalent cation transporter