

Exogenous glutathione pre-treatment enhances seeds tolerance to ageing through influencing germination and antioxidant enzymes activities in *Elymus sibiricus* L.

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**Abstract:** The aim of this study was to elucidate the effect of exogenous glutathione (GSH) pre-treatment on seed germination, antioxidant enzymes activities and lipid peroxidation of membranes in *Elymus sibiricus* L. seeds aged with 4%, 10% and 16% moisture contents (MCs) at 45 °C for 48 h. Ageing caused by MCs decreased seed germination and activities of enzymes superoxide dismutase (SOD) and catalase (CAT). However, exogenous GSH pre-treatment inhibited the loss of seed germination at 10% and 16% MCs, correspondingly, malondialdehyde (MDA) content decreased. Superoxide dismutase (SOD) was the first enzyme whose activity was significantly enhanced at 4% MC, then ascorbate peroxidase (APX) activity was significantly improved at 10% MC. Glutathione reductase (GR) activity was the last one to be improved, which could coordinate with SOD and APX to scavenge reactive oxygen species (ROS) at 16% MC. All these results suggested that exogenous GSH pre-treatment provided an effective method for enhancing seed germination and the effects were related to seed moisture levels.

**Keywords:** Ageing, Antioxidant enzymes, *Elymus sibiricus* L., Germination, Glutathione