

ABSTRACT

Expression analysis of genes encoding antioxidant enzymes in pedunculate oak (*Quercus robur* L.) seedlings treated with cadmium ions.

Pedunculate oak (*Quercus robur* L.) is one of the most important forest tree species in Poland. It is a tree of great economic significance due to its timber strength and hardness. Oak also plays a crucial role in maintaining the structure and biodiversity of ecosystem. Many studies indicate the possibility of using different species of the genus *Quercus* for afforestation of lands affected by industry, including trace-element polluted areas.

Heavy metal land contamination is a serious problem of the modern world. Cadmium is recognized as one of the most toxic pollutant due to its high mobility and low amount needed to cause the toxicity symptoms. Cadmium has been shown to cause oxidative stress, therefore sufficient antioxidative system response is a vital cell defense mechanism.

The main objective of the research was to determine the antioxidative system response of pedunculate oak to the cadmium treatment. As the response of the antioxidative system to heavy metal contamination can vary within species, the research was conducted on oak seedlings from two different regions of origin (region of origin No. 659, Świdnik Forest District, Borek forest tree nursery and region of origin No. 455, Lubartów Forest District, Stróžek forest tree nursery).

The obtained results indicate that ascorbate peroxidase and superoxide dismutase play a first barrier role in oak seedlings response to the oxidative stress caused by Cd exposure. Catalase is involved in reducing the negative effects of prolonged exposure of oak seedlings to cadmium ions.

The *Quercus robur* seedlings derived from tested regions of origin varied in their Cd accumulation ability, observed damage upon Cd exposure (leaves damage, level of lipid peroxidation) and their antioxidative system response rates, both at the transcript and enzyme activity levels.

Additionally, the results suggest the possible use of *Quercus robur* in cadmium phytostabilization, which may be of great importance during the selection of tree species for afforestation of lands contaminated with heavy metals. Higher Cd accumulation ability was observed in seedlings from Borek forest tree nursery (region of origin No. 659), however,

seedlings from Strózek forest tree nursery (region of origin No. 455) exhibited higher tolerance to cadmium exposure. Therefore, *Quercus robur* seedlings from region of origin No. 455 (Strózek forest tree nursery) are more suitable for the afforestation of heavy metals (particularly cadmium) polluted lands.

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