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BOOK OF ABSTRACTS

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T1-P-40 Effects of chronic dietary cadmium on midgut superoxide dismutase (SOD) and catalase (CAT) in larvae from two *Lymantria dispar* populations

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KEYWORDS: superoxide dismutase; catalase; *Lymantria dispar*; cadmium; biomarker

INTRODUCTION:

Cadmium (Cd) levels in the environment have increased during decades of intensive industrial development and urbanization. *Lymantria dispar* has proved to be a suitable organism indicator to monitor Cd pollution in forest ecosystems. Since insects accumulate heavy metals predominantly in the gut, it is not surprising that several enzymes in the midgut of *L. dispar* larvae, including antioxidant enzymes superoxide dismutase (SOD) and catalase (CAT), have been marked as promising biomarkers of Cd presence. Namely, Cd indirectly induces oxidative stress in the cell. However, long-term exposure of the population to pollution often results in increased tolerance and altered sensitivity of biomarkers.

OBJECTIVES:

We aimed to determine specific enzyme activities and isoform patterns of SOD and CAT in the midgut of *Lymantria dispar* larvae after chronic treatment with Cd. To assess these parameters as biomarkers of Cd exposure, we compared the responses of two populations with different histories of exposure to pollution.

METHOD / DESIGN:

Egg-masses of *L. dispar* were collected from two localities in Serbia - the uncontaminated forest in Kosmaj Mountain, which is a protected natural resource, and a polluted site near the busy Ibar highway. Larvae were fed a wheat germ diet containing 0, 50 or 100 µg Cd/g dry food starting from hatching until they were killed on the 3rd day of the 4th instar. Specific activities of SOD and CAT in the midgut homogenates were determined by spectrophotometric assays. Enzyme isoforms were separated by native polyacrylamide gel electrophoresis. Statistical analyses were performed in GraphPad Prism 7 (GraphPad Software, Inc., USA), where enzyme activities were analyzed by one-way ANOVA followed by Tukey's posthoc test. The level of statistical significance was $p<0.05$.

RESULTS:

The specific activity of SOD was higher in control larvae from the polluted locality compared to the control group from the uncontaminated forest. Exposure to both Cd concentrations decreased SOD activity in larvae from the polluted site. Three SOD isoforms were detected in control groups from both populations. While isoform SOD-2 was absent in the population from Kosmaj after the treatment with higher Cd concentration, both SOD-2 and SOD-3 disappeared in all Cd-treated larvae from the site near the highway. In the population from the unpolluted locality, specific activity of CAT was reduced at 100 µg Cd/g dry food, whereas in another population a decrease in enzyme activity was noticed at both Cd concentrations. The same pattern of Cd influence was observed for CAT isoform activity. Only one CAT isoform was present in both control and experimental larvae from both populations.

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CONCLUSIONS:

Higher SOD activity in control larvae originating from the site near the highway compared to those from the uncontaminated forest probably indicated the presence of traffic-related pollution that caused oxidative stress. However, neither SOD nor CAT showed activation in response to Cd treatment. A decrease in SOD and CAT activities in both Cd-treated groups from the population inhabiting the polluted site was most likely the result of the trade-off in favor of the alternative defense mechanism(s). Such trade-off might have led to the diminished expression of isoforms SOD-2 and SOD-3. Thus, a decrease in SOD and CAT activities after Cd exposure could be seen as an adaptive strategy in *L. dispar* populations. Specific activities of SOD and CAT with SOD isoform patterns could be used as biomarkers of Cd exposure in contaminated environments.

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T1-P-41 Differences in the root anatomical traits of three *Salix L.* clones in response to increased Cd concentrations

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KEYWORDS: *Salix*; cadmium; root; anatomy; phytoremediation

INTRODUCTION:

Among heavy metals, cadmium (Cd) is one of the most widely distributed pollutant, whose concentrations increase in the soil, water and air, globally and over time. Numerous physiological, biochemical and morphological studies have shown that woody species from the genus *Salix L.* (willows) represent suitable tools for phytoremediation of the sites polluted by cadmium. However, only a few studies have followed structural changes of the root tissues exposed to increased concentrations of Cd in soil and water. Previous physiological studies have established high cadmium accumulation in the roots of several willow clones, *Salix alba L.* clone ´B-44´, *Salix viminalis L.* clone ´SV068´, and *Salix matsudana* Koidz. clone ´SM404´.

OBJECTIVES:

The aim of our work was to assess the effects of two singly applied Cd concentrations (10^{-3} and 10^{-6} M Cd) on the roots´ anatomical traits of three willow clones, *Salix alba L.* (clone ´B-44´), *Salix viminalis L.* (clone ´SV068´), and *Salix matsudana* Koidz. (clone ´SM404´), grown in the soil contaminated with cadmium.

METHOD / DESIGN:

Plant materials consisted of one-year old stem cuttings of three willow clones, *Salix alba L.* clone ´B-44´, *Salix viminalis L.* clone ´SV068´, and *Salix matsudana* Koidz. clone ´SM404´, obtained from the Institute for Lowland Forestry and Environment (ILFE) in Novi Sad, Republic of Serbia. The clones were selected according to their properties of good Cd removal from moderately polluted soils, highest Cd content recorded in roots in comparison with aboveground organs, and clone specific response to high Cd concentrations. Willow plants were grown under semi-controled conditions (greenhouse), by soil culture method, in Mitscherlich pots containing 5 kg of soil. Plants were divided into three treatments: control (without Cd), and treatments with

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