

The concentration of heavy metals in trees bark and preferences of deers' nutrition.

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Abstract: It was compared the content of zinc, lead and cadmium in the bark of oaks (*Quercus robur L.*) and pines (*Pinus silvestris L.*). The pines are often called as “starvation quarry”. This both species are often debarked by deers. The samples of bark for investigations were taken from the trees growing at the area of industrially polluted environment (Miasteczko Śląskie). The content of heavy metals was defined by method of Flame Atomic Absorbtion Spectrophoto (FAAS). The bark preferred by deers, contained more zinc (which is necessary micro-element for animals) and far less of cadmium and lead (poisonous elements)

Keywords: Bark, micro-elements, poisonous elements, debarking

INTRODUCTION

Now days in forests fragmented into small, limited areas, population of deers increases substantially, as a result of the lack of natural beasts. Such situation reflects in damages of the trees made by animals and results negatively on quantity and quality of the wood. The most common tree's destroy is debarking which means bark off a trunks of young trees (Szukiel, 2001). Although, reasons of debarking are different (i.e. anthropogenic stress), main one seems to be the animals' demand of food. The bark is a reach source of water, proteins, fats and carbohydrates. It contains substances that are necessary for digestion process for ruminants, like: cellulose, hemicelluloses, lignin. It is also a source of vitamins from B group, vitamin C and nicotinic acid. The bark of the trees is also rich in macro- and micro-elements. (Szukiel, 1973; Morow, 2001). Despite of demanded by animals substances, the bark can also consist poisonous elements i.e. heavy metals, like cadmium and lead. The capability to cumulate poisonous elements in plants' cells differs and depends on tree species (Kłosińska and Bałaga, 2007; Kłosińska and Maciejewski, 2007)

The deers show up clear preferences of the kind of a tree (species) to be debarked. Deciduous trees are subject of higher debarking risk than conifer ones, fir tree (*Abies alba Mill*) is an exception. The most attractive species for the deers are: oaks (*Quercus sp. div.*), ash (*Fraxinus sp. div.*), sycamore (*Acer pseudoplatanus*), hornbeam (*Carpinus sp. div.*), lime-tree (*Tilia sp. div.*), willow (*Salix sp. div.*). The last attractive species by the deers is pine-tree, called: “starvation quarry” (Kłosińska and Kowalczyk, 2005). The reasons of such food preferences are not known, so far. This is very difficult to answer the question of which chemical substances are the most important for animals because of very diverse chemical content of the barks. In the presented investigations were compared quantity of poisonous elements (cadmium and lead) and micro-element of zinc in the bark of the trees the most preferred to be debarked (oaks) and the last attractive for debarking (pines).

MATERIALS AND METHODS

The investigation was conducted basing on the bark's samples taken out of the trees of pine (*Pinus sylvestris L.*) and oak (*Quercus robur L.*) from the area of Miasteczko Śląskie

(highly polluted, mainly by heavy metals, industrial area). The samples were taken at the height of 1,5m (at this height debarking of young trees by deers happens the most often). The samples come out from, 30 pines and 30 oaks, age class Ib. After a careful cleaning and crumbling of the bark, chemical analysis was made in purpose to define the content of zinc (Zn), cadmium (Cd) and lead (Pb). To define the content of metals, the method of Flame Atomic Absorbtion Spectrophoto (FAAS) was used. In this method quantity analysis is based on measurement of intensity of radiation emission by atoms of each element (Cygański, 1997). The data concerning content of elements in the trees bark were analyzed using Student's test at the 0,01 or 0,05 significance level for comparison of values.

RESULTS AND DISCUSSION

Although, zinc the same as a most of micro-elements in it's redundancy is poisonous, it provides desirable nutrient for animals, as a matter of being part of many enzymes (i.e. Kabata-Pendias, Pendias, 1979).

It was discovered that in the bark of species preferred by deers, like oak, the content of zinc is higher than in the bark of species called "starvation quarry" – pine-tree (Fig. 1). In case of the oak's bark concentration of zinc was 91,4 mg/kg (SD = 4,35), whereas in pine-trees's bark – 80,6 mg/kg (SD = 5,44). Differences in zinc concentration between trees were statistically significant ($P = 0,05$). The similar relationship but in lower element concentration was discovered also for trees from non-polluted areas (Kłosińska, Bałaga, 2007; Kłosińska, Maciejewski, 2007).

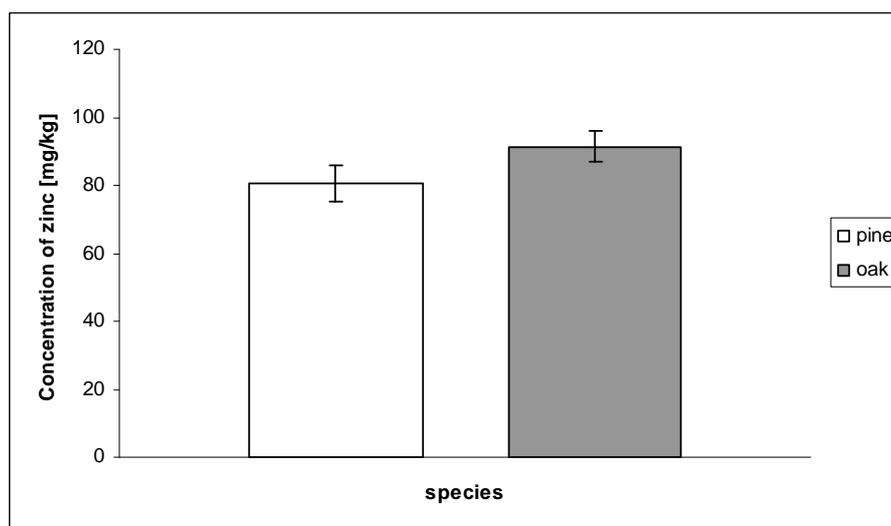


Fig. 1. The zinc concentration in the bark of pine and oak from polluted area, respectively. Vertical bars denote standard deviation, n=30.

In case of poisonous elements, it was discovered the lower concentration in the bark of oak than in the bark of pine-tree. It refers both to cadmium: 3,9 mg/kg (SD = 0,91) for bark of pine-tree and 1,6 mg/kg (SD = 0,87) for the bark of oak and to lead: 206mg/kg (SD = 16,82) for bark of pine-tree and 77 mg/kg (SD = 10,24) for bark of oak. (Fig. 2, 3). Differences in concentration of these elements in bark of analyzed trees were statistically significant at $P = 0,05$ in case of cadmium and $P = 0,01$ for lead.

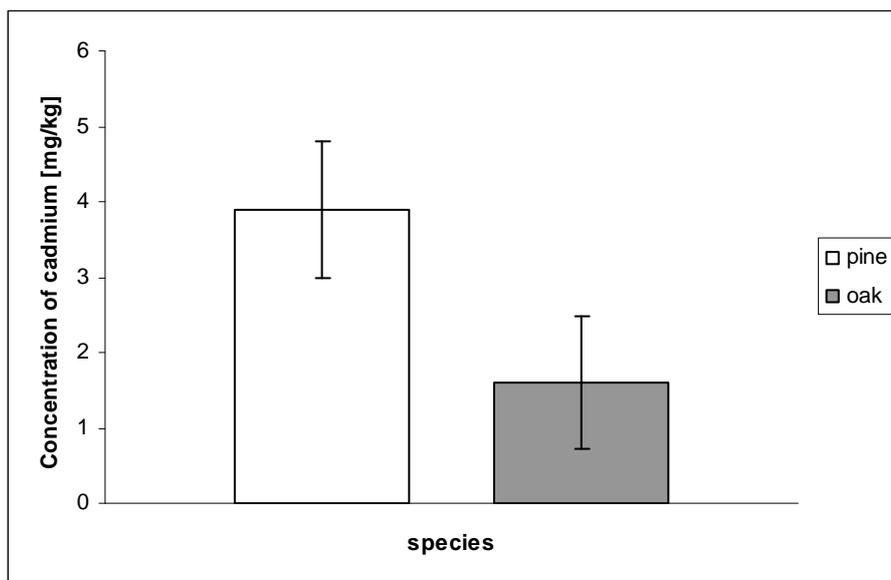


Fig. 2. The cadmium concentration in the bark of pine and oak from polluted area, respectively. Vertical bars denote standard deviation, n = 30.

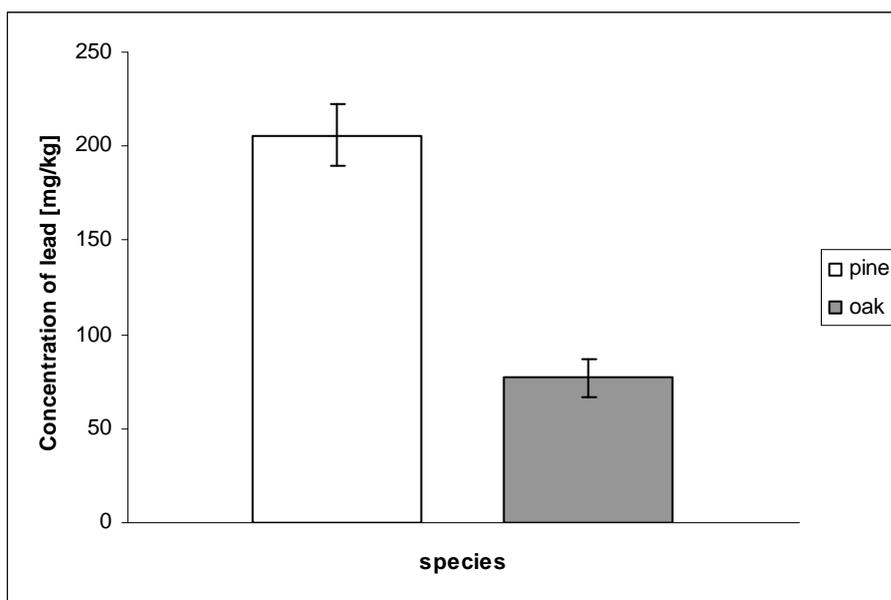


Fig. 3. The lead concentration in the bark of pine and oak from polluted area, respectively. Vertical bars denote standard deviation, n=30.

CONCUSIONS

In case of debarking of pine-trees from the industrially polluted areas, animals not only destroy the trees, but also include many poisonous metals in nutrient chain. We can conclude that pine-tree is not the right species to plant at the areas in the neighborhood of industrial zones, particularly if the deers are living there. It is also important fact that pine-tree in opposition to the oak, is a species very sensitive for industrial pollutions (Greszta et al., 2002)

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Streszczenie: Zawartość metali ciężkich (Zn, Cd, Pb) w korze drzew a preferencje pokarmowe zwierzyny płowej. Porównano zawartość cynku, ołowiu i kadmu w korze gatunku chętnie spalowanego przez zwierzynę płową dębu szypułkowego (*Quercus rober L.*) i gatunku traktowanego jako tzw. „żer głodowy” – sosny zwyczajnej (*Pinus sylvestris L.*). Kora została pobrana z drzew rosnących w środowisku skażonym przemysłowo (Miasteczko Śląskie). Zawartość metali ciężkich określano metodą absorpcyjnej spektrometrii atomowej w wersji płomieniowej. W przypadku kory preferowanej przez jeleniowate zawierała ona większe ilości cynku (niezbędny dla zwierząt mikroelement) i znacznie mniejsze ilości kadmu i ołowiu (pierwiastki toksyczne).

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