EFFECT OF POLLUTION WITH CEMENT DUST UPON SUPEROXID – DISMUTASE ACTIVITY AT DIFFERENT PLANT SPECIES

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Abstract. In the present study was monitorized the dinamic of superoxid - dismutase activity (SOD) in some plant species from spontaneous vegetation, harvested from area with different polution degree with cement dust, proving the importance of these enyzme in assuring of plant tolerance to the xenobiotic stress.

INTRODUCTION

Reactive oxygen species (ROS) like singlet oxygen-O_2^1, superoxide radicals-O_2^-, hydrogen peroxide-H_2O_2, hydroxyl radicals-HO^- superoxid radical (O_2^-) and hydrogen peroxide (H_20_2), are present in all aerobic organisms (Bailey-Serres and Mittler, 2002). In unstressed plant cells these reactive forms are generated, usually, at low level (in chloroplasts and mitochondria or by citoplasmic enzymes implied in redox reaction). In case of abiotic stress of plants, ROS are eliberated fast and in large quantity, as a result of secvential reduction of molecular oxygen (O_2). Opposite to the oxygen, the reactive oxygen species are very reactive and toxic compounds, witch induce oxidative deteriorations of cells. ROS are important for environmental response mechanisms of plants and regulators of growth, development and defence pathways (Mittler et al., 2004)

The improvement of the organisms defense systems against ROS and also, the last information about their role, demonstrate a dual character, this compounds being toxic products of aerobic metabolism, but, also, being the key regulators of metabolism pathway and defence.

The ROS level in different subcellular compartments is determinate by various ROS producing pathway and by implication of removing mechanisms of them.

Besides of ROS aerobic methabolism producing pathway (photosynthesis and respiration) there is and another sources witch are being represented by the pathway witch intensify their activity after abiotic stress (photorespiration).

In order to minimize disorders induced at celullar level by these free radicals, in plant is acting an endogenous anti-oxidative defense system. Major reactive oxygen species scavenging mechanisms in plants are superoxide dismutase, catalase and peroxidases. The balance between superoxide dismutase and catalase or peroxidases is crucial for determining the steady-state level of superoxide radicals and hydrogen peroxide and prevents the formation of toxic radical hydroxyl (Mittler, 2002). Thus, the plant protection against these free radicals depends on the efficiency of this endogenous defense system.

MATERIAL AND METHODS

Biological material: the plants (*Trifolium pratense, Lotus corniculatus, Plantago lanceolata, Plantago major, Fagus silvatica, Populus tremula, Abies alba, Picea abies, Crataegus monogyna, Salix fragilis*) were harvested in three different stadia, during the vegetation period, from different aria regarding the grade of pollution with cement dust, witch are coming from CARPACEMENT FACTORY – NEAMT, as follows: I.- Potoci (control – unpolluted plants), II. - Tasca, III – Carpatcement Tasca, IV.- Carpacement loading point.

Enzymatic assay: superoxid-dismutase activity was assayed in leaves using colorimetric method according to Winterbourn (Winterbourn et al., 1975). This method is based on the ability of superoxid-dismutase to inhibit the reduction of nitroblue tetrazolium by superoxide. One unit is defined as that amount of enzyme causing half the maximum inhibition of nitroblue tetrazolium reduction.

RESULTS AND DISCUTIONS

Our investigations has showed that superoxid dismutase activity has recorded an intensification in the first two harvesting stadia (7.06.2006 and 13.07.2006), when the plants are in the conditions of active vegetation, and the reaction toward xenobiotics factors is faster. Also, in many plants, excepted woody species, this intensification is positive correlate with pollution degree. Thus, at *Trifolium pratense and Plantago lanceolata* harvested from areas with highest pollution degree, at 7.06.2006, the SOD activity has recorded 94,88% and 71,2% inhibition (Carpatcement Tasca), comparing with 77,45% and, respectively, 66,89% inhibition (Potoci - control)(Figures 1 and 3).

The same behavior was registered in samples (*Trifolium pretense, Plantago lanceolata and Plantago media* plants) harvested at 13.07.2006, where the highest activity (89,77% inhibition).

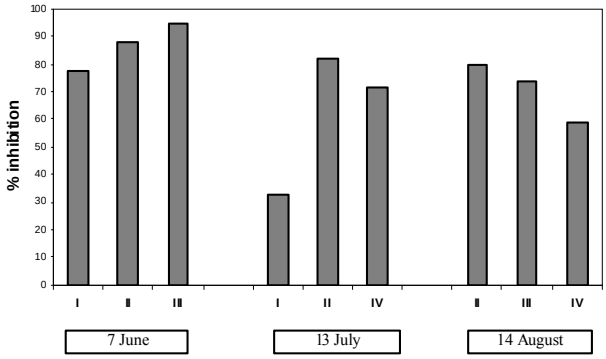

FIGURE 1 – Superoxid – dismutase activity (SOD) at *Trifolium pratense* plants, harvested from area with different pollution degree
(I – Potoci, II – Tasca, III –Carpatcement Tasca, IV – Carpatcement loaded point)

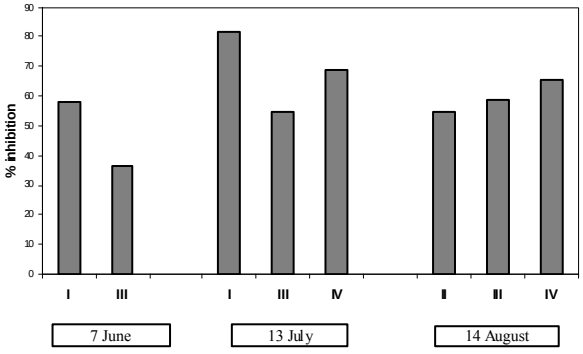

FIGURE 2 - Superoxid – dismutase activity (SOD) at *Lotus corniculatus* plants harvested from area with different pollution degree
(I – Potoci, II – Tasca, III – Carpatcement Tasca, IV – Carpatcement loaded point)

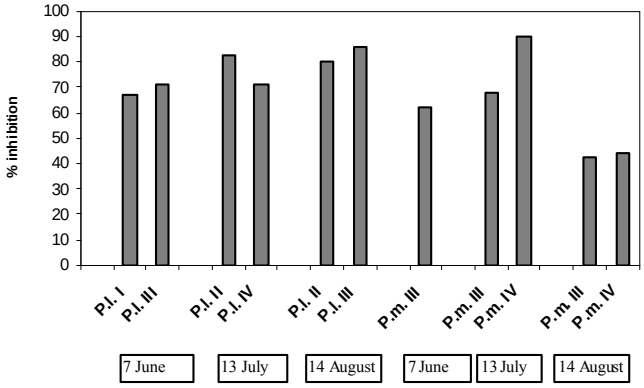

FIGURE 3 – Superoxid – dismutase activity (SOD) at *Plantago lanceolata* (P.l.) and *Plantago major* (P.m.) plants, harvested from area with different pollution degree (I – Potoci, II – Tasca, III –Carpatcement Tasca, IV – Carpatcement loaded point)

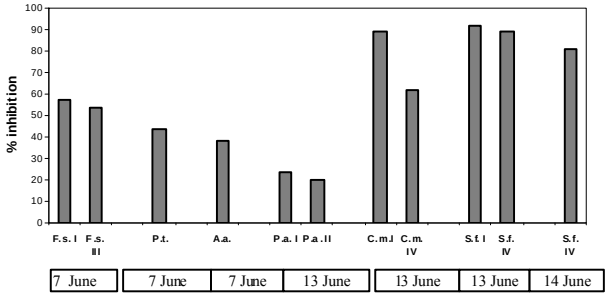

FIGURE4 – Superoxid – dismutase activity (SOD) at *Fagus silvatica* (Fs I, III.), *Populus tremula* (Pt), *Abies alba* (Aa), *Picea abies* (Pa),*Crataegus monogyna* (Cm), *Salix fragilis* (Sf) plants, harvested from area with different pollution degree (I – Potoci, II – Tasca, III –Carpatcement Tasca, IV – Carpatcement loaded point)

was recorded in leaves from Carpatcement loading point (IV), comparing with 67,92 % inhibition, in plants harvested from less polluted area (Carpatcement Tasca).

Lotus corniculatus plants doesn't respond in the same way to the pollution factor, the level of superoxid-dismutase activity in leaves from Carpatcement Tasca (III) polluted area being more reduced (36,20% inhibition – 7.06.2006 and 54,60% inhibition -13.07.2006) comparing with registered values in control plants (Potoci area), as follows: 57,80% inhibition (7.06.2006) and 81,80% inhibition (13.07.2006) (Figure 2).

In the case of woody plants, the lowest SOD activity has been recorded in *Crataegus monogyna* plants, with 61,30% inhibition in leaves with highest pollution level (Carpatcement loading point) towards 88,37% inhibition in control plants (Potoci area) (Figure 4).

The purpose of superoxid – dismutase (SOD) assay in these experiments, was generated by knowledge of implication of these enzyme in defense mechanisms of plants towards structural and functional degenerations of cell membranes under free radicals actions, first generated being O_2^-.

Otherwise, because activated oxygen is necessary to detoxify xenobiotic chemicals, in plant cells is absolutely necessary maintaining of a balance between oxygen free radicals reactivity level and antioxidant enzymatic system activity level, under pollution stress condition.

Maintenance of this balance is critical in order to keep an active development and normal metabolism of plants and, also, in assuring a good tolerance to environmental stress.

In these conditions, it's considered that SOD activity intensification at *T. pratense, P. lanceolata* and *P. media* species, harvested from polluted area (Carpatcement Tasca and Carpatcement loading point) signify a rapid reaction of plants to oxidative stress and could be considered, from this point of view, like tolerants to pollutants actions.

The phenomenon of decreasing of SOD activity at *Lotus corniculatus* plants and, also, at woody species tested, more intense in *Crataegus monogyna* plants, could signify only a sensitivity of these species to pollutant factor by inhibition of normal respiration and photosynthesis mechanisms in leaves.

CONCLUSIONS

SOD activity has been increased in plant cells like response to xenobiotic stress, it's activity being regulated depends on oxidative stress intensity.

A higher SOD activity at *T. pratense, P. lanceolata* and *P. media* species, harvested from high polluted area (Carpatcement Tasca and Carpatcement loading point) signify a faster reaction of plants to oxidative stress, witch could be considered like tolerants to the pollutants reaction.

In very high pollution conditions the cement dust can cause chlorosis and cell death, but this fact was not noticed in our experiments, even in high pollluted plants situations.

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