ACTIVITY OF LIPID PEROXIDATION AND CATALASE IN LEAVES OF WOODY PLANTS IN CONDITIONS OF TECHNOGENIC STRESS

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Study was carried out to assess the impact of cement industry pollution (for example, OJSC «Krasnoselskstroymaterialy»), on woody plants. Significant differences were found for average concentration of catalase activity and malondialdehyde in technogenic and background conditions. In the conditions of emissions of gaseous substances into the air by the enterprise for the production of building materials, the development of oxidative stress was observed, accompanied by an increase of lipid peroxidation and unidirectional changes in the activity of the catalase enzyme.

Keywords: technogenesis, cement industry, woody plants, lipid peroxidation, MDA, catalase activity.

The most dangerous consequence of the growth of woody plants in technogenic contaminated conditions can be considered the development of oxidative stress, accompanied by excessive generation of reactive oxygen species (ROS). One of the main targets of ROS action are lipids – the main components of cell membranes. ROS are able to initiate their lipid peroxidation, which results in damage to these structures associated with dysfunction of membrane proteins. It is found in a phenomenon called "membrane leakage", which is manifested in an increase in permeability to ions and organic substances [1]. In addition, the products of lipid peroxidation (4-hydroxyalkenal, malondialdehyde, etc.) have mutagenic activity and block cell division [2].

Despite the available literature data on the physiological role of ROS formed in the plant cell, it should be understood that their excessive generation can lead the cell to inevitable death. However, normally this does not occur, which is explained by the presence of a pool of a large group of enzymes and non-enzymatic compounds that exhibit antioxidant properties and neutralize reactive derivatives of molecular oxygen without the formation of any other toxic substances. The detoxification of ROS involves high-molecular antioxidant enzymes, among which the most important role is played by superoxide dismutase, catalase, peroxidase group, ascorbate-glutathione enzymes [3, 4]. Detoxification of ROS with the participation of enzymes is possible if the substrate reaction rate constant with ROS in physiological conditions is low. In this regard, the neutralization of reactive oxygen derivatives such as singlet oxygen, hydroperoxide radical, hydroxylradical and peroxynitrite is not under enzymatic control, since the rate constants of their interaction with potential reaction partners in a typical environment are very high (more often $k>10^8$) for enzymatic catalysis [5]. Thus, antioxidant enzymes catalyze mainly the detoxification reactions of superoxide and hydrogen peroxide.

Catalase (CAT, EC: 1.11.1.6) is always present in systems where cellular respiration processes involving cytochromes occur, where hydrogen peroxide is formed as a result of oxygen reduction [6]. The essence of the catalytic action of catalase is the decomposition of hydrogen peroxide with the release of molecular oxygen. One molecule of the enzyme can cause the decay of $6 \cdot 10^6$ molecules of hydrogen peroxide per second.

The studies were carried out in summer (July). In the framework of the study, the activity of catalase in the needles *Pinus sylvestris* L. and in the leaves of *Betula pendula* Roth, growing in the gradient of the distance from the enterprise for the production of building materials of OJSC «Krasnoselskstroymaterialy», was studied.

Catalase activity was determined by a gasometric method, which is based on the determination of the amount of oxygen released under the influence of aqueous extracts of plant tissues containing the enzyme on hydrogen peroxide [7]. The intensity of lipid peroxidation was judged by the accumulation of malonic dialdehyde (MDA) reacting with thiobarbituric acid (specific absorption at 532 nm) [8].

In the leaves of woody plants growing under conditions of technogenic (gas-dust) pollution, activation of the lipid peroxidation was observed. The greatest increase was recorded at a distance of 1–2 km from the source of pollution in the leaves of *Betula pendula* Roth. – at 19–34 %, and in the needles of the *Pinus sylvestris* L. – at 19–37 %. Reinforced of lipid peroxidation and accumulation of MDA can lead to disruption of membrane integrity and cell damage. In the conditions of oxidative stress, the life time of the formed ROS and their toxic effect is controlled by the antioxidant protection system of the cell.

It should be noted that the change in catalase activity under technogenic stress was one-directional. The study showed that catalase activity in the leaves of woody plants under conditions of technogenic stress is significantly changed, the indicator of the activity of the enzyme catalase in the needles of *Pinus sylvestris* L. were characterized by the lowest values. Thus, in the Pinus sylvestris, there was a decrease in the activity of catalase at

a distance of 1–2,5 km in the south-eastern direction and 5 km in the north-eastern direction by 2,03–2,6 times. For *Betula pendula* Roth. there was a decrease in catalase activity only at a distance of 1 km in the south-west, south-east and north-east directions by 1,3–1,7 times.

Thus, the study showed that in the leaves of woody plants growing in a technogenically contaminated environment (in the conditions of emissions of gaseous substances into the air by the enterprise for the production of building materials), the development of oxidative stress was observed, accompanied by an increase of lipid peroxidation and unidirectional changes in the activity of the catalase enzyme.

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FEATURES OF THE DEVELOPMENT OF MANTIS RELIGIOSA IN THE PROCESS OF ONTOGENESIS IN LABORATORY CONDITIONS

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The process of Mantis religiosa individual development in the conditions of a laboratory experiment has been traced. The optimum of temperature conditions at larval hatching has been revealed; the processes of adaptation to the offspring preservation have been noted. The features of sex's relations in captivity have been established.

Keywords: optimum, adaptation,ontogenesis.

Purpose: to reveal the optimal parameters of an individual development from an egg to an imago.
Tasks:
1. to determine an optimal temperature regime
2. to show the role of sex's relations in captivity
3. to detect the nature of a copulation process
4. to trace the ways of Mantis religiosa settlement on the territory of Belarus.