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# The Growth Reaction, Membrane Potential and Oxidative Stress of Maize Coleoptile Cells Incubated in the Presence of the Naphthoquinones

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**Abstract :** Introduction: Naphthoquinones are widely occurring organic compounds produced by bacteria, fungi, and plants. They can act as the functional components of biochemical systems (plastoquinone) as well as biologically active substances, which have a negative impact on environmental processes. Naphthoquinones seem to act through two mechanisms: a covalent modification of biological molecules at their nucleophilic sites or by generation of reactive oxygen species (ROS) connected with redox cycling. Investigating the effect of naphthoquinones (1,4-naphthoquinone, lawsone and naphthazarin) on the elongation growth, membrane potential and the level of oxidative stress of maize cells seems to be important due to the possibility of using these substances as herbicides. Methods: All experiments were performed on etiolated maize coleoptile segments. Simultaneous measurements of elongation growth and pH of the incubation medium were carried out using an angular position transducer, allowing a precise record of the growth kinetics. To compare the oxidative stress level induced by all tested naphthoquinones, the changes in malondialdehyde content, as well as superoxide dismutase and catalase activities were measured. In order to measure the membrane potential of parenchymal cells the standard electrophysiology technique was used. Results: Naphthoquinones such as: 1,4-naphthoquinone, lawsone and naphthazarin were studied. It was found that all of the naphthoquinones diminished the growth of the maize coleoptile cells depending on the type of naphthoquinones and their concentration. Interestingly, naphthazarin at the intermediate concentration was less toxic compared to the others. In addition, the effect of naphthoquinones on the oxidative stress was dependent on their concentration as well. Superoxide dismutase and catalase activities were changed in the presence of higher concentrations of naphthoquinones. Similar interrelations were observed for membrane potential changes. Conclusion: It can be concluded that naphthoquinones tested differ in their toxic effect on the growth of maize coleoptile cells. Furthermore, naphthoquinones can be distinguish considering the oxidative stress level and membrane potential changes. The results presented here give new insight into the possible opportunities of practical usage of naphthoquinones for herbicides improvement.

**Keywords :** growth rate, membrane potential, naphthoquinones, oxidative stress
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