

**THE MODIFICATION OF PHOTOELECTRIC PHENOMENA BY  
SOME IONS OF HEAVY METALS IN PLANT CELLS**

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The nature of the specific electrical reaction of plants to the action of different factors, such as temperature, light, electrical current and chemical agents, is an important problem in plant physiology. A light signal causes an electrical response of a specific nature. In general, the photoreaction depends on photosynthesis and the transport of ions across membranes in the chloroplasts and across plasmalemma (Linnemayer *et al.* 1990, Elzenga *et al.* 1995, Shabala & Newman 1999). Changes in electrical potentials in cells of higher plants are closely related to changes in different environmental factors, such as environmental heavy metal concentrations. The aim of this study was to examine the photoelectric reaction of bean and maize plants treated with cadmium at different concentrations. The experiments were carried out on 10-13 day old plants (*Phaseolus vulgaris* L. var. Wiejska (dicotyledonous) and *Zea mays* L. var K33xF2 (monocotyledonous)). Cadmium was added to the nutrient solution to a final concentration of  $10^{-9}$  –  $10^{-4}$  mol(CdCl<sub>2</sub>)dm<sup>-3</sup> hours prior to electrical measurements. Electric potential differences were measured with the conventional electrophysiological technique using calomel electrodes, high input impedance d.c. amplifiers and a high speed multichannel chart recorder (type K-66 Rikadenki). A light intensity of 750 W·m<sup>-2</sup> was measured with a moll thermopile (type CA-1, Kipp and Zonen). The period of illumination was kept constant in each series of experiments and was 3 min. The concentration of cadmium ions in the leaves of plants was measured using emission spectroscopy (ICP-AES) and the atomic absorption method. The results suggest that in plants treated with cadmium ions, the photoelectric reaction is significantly reduced. It is possible that the primary influence of heavy metals on the plant cell depends on their interaction with the plasmalemma. Cadmium has been reported to stimulate changes in some membrane electric parameters of plant cells such as resting potential, the ability to generate potentials, membrane permeability and the speed of cytoplasm circulation. The inhibitory influence of cadmium ions on the generation of photoelectric potentials processes in plant cells observed in this study may be explained as a blockade of ionic transport and the ionic

pumps, especially the proton pump, which is localized in plasmalemma membranes.

## REFERENCES

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