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Assessment of Cytotoxic Effects of Chronic Exposure to Copper and Cadmium in Hemolymph and Midgut Glands of the *Steatoda Grossa* (Theridiidae) Spider

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Extended Abstract

Spiders play a crucial role in regulating insect populations in meadows, forests, and agricultural ecosystems. Although the importance of these carnivorous invertebrates in trophic chains of terrestrial ecosystems seems obvious, only a small number of research has been conducted under controlled laboratory conditions. This research allows for the correlation of levels of selected cellular parameters and the intensity of stressing factors, including metals. In anthropogenically polluted environments, the survival and effective role of spiders as essential predators, as well as concentrators of metals, rely on their ability to withstand excessive elements entering their bodies, primarily through the digestive tract [1]. The sensitivity of spiders to metals may hinge on the metabolic condition of their hemocytes, involved in both humoral and cellular immunological reactions, and the state of midgut gland cells, where ingested metals from food can accumulate. [2].

This study aims to verify whether and to what extent xenobiotic cadmium and biogenic copper, administered to *Steatoda grossa* (Theridiidae) females in a simple food chain model with sublethal concentrations for spiders (medium with 0.248 mM $CdCl_2$ or 0.234 mM $CuSO_4$) → *Drosophila hydei* → spider, can cause degenerative changes in hemocytes and midgut gland cells during chronic intoxication (individuals exposed to metals over two generations). Additionally, under *in vitro* and *in vivo* conditions, the study compared the hemocytes' ability to undergo oxygen burst reactions in response to receiving phorbol 12-myristate 13-acetate (PMA) as a synthetic immunostimulant, simulating conditions of possible contact with microorganisms [3]. Both types of cells were assessed for quantitative (flow cytometry) and qualitative (Transmission Electron Microscopy) apoptotic, necrotic, or autophagic processes, as well as the percentage of cells with high-level reactive oxygen species (ROS+).

This study confirmed that chronic exposure to cadmium and copper caused stronger degenerative changes in the hemocytes of *S. grossa* (Theridiidae) spiders compared to midgut gland cells. However, in midgut gland cells, the percentage of ROS+ cells exceeded that in hemocytes. In PMA-stimulated spiders, both types of cells exhibited strong prooxidative and degenerative effects from metals, significantly higher than in individuals exposed solely to metals. These results provide unique comparative data concerning the development of tolerance to metals present in food and aid in interpreting findings from field studies on these carnivorous invertebrates.

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