

## **Autophagy in the Midgut Epithelium of *Spodoptera exigua* Hübner (Lepidoptera: Noctuidae) Larvae Exposed to Various Cadmium Concentration - 6-Generational Exposure**

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**Abstract :** Autophagy is a form of cell remodeling in which an internalization of organelles into vacuoles that are called autophagosomes occur. Autophagosomes are the targets of lysosomes, thus causing digestion of cytoplasmic components. Eventually, it can lead to the death of the entire cell. However, in response to several stress factors, e.g., starvation, heavy metals (e.g., cadmium) autophagy can also act as a pro-survival factor, protecting the cell against its death. The main aim of our studies was to check if the process of autophagy, which could appear in the midgut epithelium after Cd treatment, can be fixed during the following generations of insects. As a model animal, we chose the beet armyworm *Spodoptera exigua* Hübner (Lepidoptera: Noctuidae), a well-known polyphagous pest of many vegetable crops. We analyzed specimens at final larval stage (5th larval stage), due to its hyperphagy, resulting in great amount of cadmium assimilate. The culture consisted of two strains: a control strain (K) fed a standard diet, and a cadmium strain (Cd), fed on standard diet supplemented with cadmium (44 mg Cd per kg of dry weight of food) for 146 generations, both strains. In addition, the control insects were transferred to the Cd supplemented diet (5 mg Cd per kg of dry weight of food, 10 mg Cd per kg of dry weight of food, 20 mg Cd per kg of dry weight of food, 44 mg Cd per kg of dry weight of food). Therefore, we obtained Cd1, Cd2, Cd3 and KCd experimental groups. Autophagy has been examined using transmission electron microscope. During this process, degenerated organelles were surrounded by a membranous phagophore and enclosed in an autophagosome. Eventually, after the autophagosome fused with a lysosome, an autolysosome was formed and the process of the digestion of organelles began. During the 1st year of the experiment, we analyzed specimens of 6 generations in all the lines. The intensity of autophagy depends significantly on the generation, tissue and cadmium concentration in the insect rearing medium. In the I<sup>st</sup>, II<sup>nd</sup>, III<sup>rd</sup>, IV<sup>th</sup>, V<sup>th</sup> and VI<sup>th</sup> generation the intensity of autophagy in the midguts from cadmium-exposed strains decreased gradually according to the following order of strains: Cd1, Cd2, Cd3 and KCd. The higher amount of cells with autophagy was observed in Cd1 and Cd2. However, it was still higher than the percentage of cells with autophagy in the same tissues of the insects from the control and multigenerational cadmium strain. This may indicate that during 6-generational exposure to various Cd concentration, a preserved tolerance to cadmium was not maintained. The study has been financed by the National Science Centre Poland, grant no 2016/21/B/NZ8/00831.

**Keywords :** autophagy, cell death, digestive system, ultrastructure

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