Plastic materials are composed of polymers obtained through the polymerization of monomers. Their high durability, cost-effectiveness, and versatility have made polymeric materials indispensable to human life. At the same time, the continuously increasing production of plastic waste has become one of the most serious environmental threats, also affecting the health and life of animals and humans. The species *Galleria mellonella* is frequently used as a model organism in scientific research. Literature data also indicate the ability of this species to biodegrade plastics, including polypropylene (PP). The aim of this doctoral dissertation was to investigate the effects of a polypropylene-based diet on the ultrastructure and activation of selected cytotoxicity parameters in chosen organs of *G. mellonella* larvae. The analyses focused on the midgut, fat body, and silk gland. Larvae in the final (VII) developmental stage were selected for the study. Individual parameters were compared among control specimens (fed a standard diet), starved specimens, and specimens fed PP for 24 h and 48 h. A comprehensive research strategy was adopted, combining qualitative analyses using transmission electron microscopy (TEM) and confocal microscopy with quantitative analyses based on flow cytometry, luminometry, and statistical methods. TEM analyses revealed differences in the number of autophagic structures in the examined organs of PP-fed individuals compared with the control groups. Confocal microscopy also demonstrated differences in signal intensity from acidic organelles and ROS+ cells, as well as changes in mitochondrial membrane potential and antioxidant production levels between the experimental and control groups. Quantitative analyses using flow cytometry revealed significant differences in the percentage of viable cells, the level of DNA damage, the abundance of ROS+ cell populations, Bcl-2 protein expression, and alterations in the cell cycle. Furthermore, luminometric analyses enabled visualization of the ADP/ATP ratio and ATP levels in organs from the analyzed groups. The observed increase in cellular damage in the examined organs following PP ingestion was compensated for by a range of processes, such as intensified autophagy, increased cellular vacuolization, and activation of antioxidant mechanisms, demonstrating the regenerative capabilities of *G. mellonella* larval organs. Correlating these findings with the high survival rate of the studied individuals may indicate the potential for broader application of this species.

These studies fill the existing gap in data concerning the cellular and ultrastructural effects of plastics in *G. mellonella* and constitute a significant contribution to research on the potential use of this species in polypropylene biodegradation processes.