

ABSTRACT

The freshwater shrimp *Neocaridina davidi* (*N. heteropoda*) (Crustacea, Malacostraca, Decapoda) originates from Asia and is one of the species that is widely available all over the world, because it is the most popular shrimp that is bred in aquaria. The endodermal region of the alimentary system in analyzed species consists of an intestine and a hepatopancreas. The intestine is a tube-shaped organ and the hepatopancreas is composed of two large diverticles that are divided into the blind-end tubules. Hepatopancreatic tubules have three distinct zones – proximal, medial and distal. Among the epithelial cells of the intestine, two types of cells were distinguished – D and E-cells, while three types of cells were observed in the epithelium of the hepatopancreas – F, B and E-cells. Each cell type has a specific role in digestion. The structure and ultrastructure of the midgut have been described using X-ray microtomography, transmission electron microscopy, light and fluorescence microscopes.

Three types of cell death were observed in the intestine and hepatopancreas – apoptosis, necrosis and autophagy. Degeneration processes involve the fully developed cells of the midgut epithelium that have contact with the midgut lumen – D-cells in the intestine and B- and F-cells in hepatopancreas, while E-cells (midgut stem cells) did not die. A distinct correlation between the accumulation of E-cells and the activation of apoptosis was detected in the anterior region of the intestine, while necrosis was an accidental process. Degenerating organelles, mainly mitochondria were neutralized and eventually, the activation of cell death was prevented in the entire epithelium due to autophagy. Therefore, we state that autophagy plays a role of the survival factor. To describe and detect cell death, the transmission electron microscopy, light and confocal microscopes were used.

N. davidi develop indirectly, with characteristic pelagic larvae form. Conducted study revealed that while the intestine in both larval stages of *N. davidi* has the form of a fully developed organ, which resembles that of adult specimens, the hepatopancreas undergoes elongation and differentiation. E-cells, which are midgut stem cells, due to their proliferation and differentiation are responsible for the above-mentioned processes. Apoptosis is a common process in both larval stages of *N. davidi* in the intestine and proximal region of the hepatopancreas. In zoea III, autophagy as a survival factor is activated in order to protect cells against their death. The presence of all types of cell death in the midgut in the zoea III stage confirms that this part of the digestive tract is fully developed and functional.