Summary

The rapid development of the plastics industry, which began in the 1950s, has led to the mass production and global use of plastics in many economic sectors. Low production costs, durability and diverse properties have made these plastics widespread, readily available and often disposable. This has a direct impact on the amount of waste produced, which is only minimally recycled and most often ends up in landfills, where biotic and abiotic factors promote their fragmentation and the release of fine particles called microplastics (MP).

The work describes the nomenclature associated with microplastics differentiating them by size and origin, discusses possible migration routes, effects on aquatic and terrestrial ecosystems, as well as complex relationships considering particle mobility. He discusses cases of plastic accumulation in animal bodies, both marine and terrestrial invertebrates, including mammals. It also points out the problem of the occurrence of microplastics in soils, the threat they pose to this ecosystem in general, and the extensive methodology for their effective detection. In the following sections, the paper focuses on the role of earthworms as organisms capable of coexisting in microplastic-contaminated environments, thus raising a number of questions about their possible use in soil bioindication processes and potential applications in environmental engineering.

The research part of the paper describes the ways in which selected earthworm species, representing different ecological groups, can be differentiated: (*Lumbricus terrestris, Dendrobaena veneta, Apporectoda Caliginosa, Eisenia fetida* and *Eisenia andrei*) with respect to their sensitivity to the presence of MP contamination in the soil were described. Based on the results of the study, among other indirect markers of detoxification and the adaptive response of organisms to environmental stressors, including microplastics, and overall individual and species survival, two species were selected for further cognitive analyses.

Microplastics of varying chemical properties, sizes and shapes were used in this study, for correct representation of natural environmental pollution, and the pilot fraction was spherical fluorescent green polyethylene (PE) microspheres in sizes of 1-5 μm, 10-20 μm, 32-38 μm, 38-45 μm and 53-63 μm, and purple polyethylene microspheres in sizes

of 38-45 μm and 75-90 μm. Polyethylene terephthalate (PET) in the form of irregular pellets of 10-5000 μm, polyamide (PA) in the form of fibres of 10-2000 μm and polystyrene (PS) in the form of irregular film shreds of 10-5000 μm were also used.

The paper describes methods of extracting earthworm tissues and the method of microplastic detection using complex apparatus such as Raman and optical microscopy, Echo respirometry or Fourier transform infrared spectroscopy (FTIR) to determine the spatial position and structure of chemical bonds. In addition, there was a discussion of the totality of studies carried out in a similar way and the differences resulting, among other things, from the accuracy and resolution of the measuring equipment used in the available publications.

The final chapters of the dissertation summarize the methods described and, on this basis, determine the correlation of microplastic concentrations in soil and earthworm tissues. The information contained in the dissertation confirms the correlations and is supported by statistical analyses to illustrate the accumulation issue more fully. In addition, the work describes and confirms the significant differences in plastic concentrations in the tissues and in general of earthworms reared at the laboratory scale and outdoor culture.

Based on the research, biochemical and microbiological analyses, it was determined that *Lumbricus terrestris* and *Dendrobaena veneta* were the species best adapted to living in soil with microplastic content. The measuring apparatus used during the work allowed precise detection of particles contained in tissues, and mathematical modeling made it possible to determine soil/tissue concentration correlations. This could be extremely important in an environmental engineering perspective providing new opportunities in soil quality monitoring methodology.