

### **Project Significance:**

Animal production and the agricultural sector face major challenges in the 21<sup>st</sup> century. Water scarcity, already evident today, is expected to intensify, leading to reduced crop yields. As a result, competition for food resources between livestock and humans will increase. However, effective drinking water management remains insufficient. In Poland alone, approximately 9 million tons of organic matter (worth €40 million), rich in water, are wasted and landfilled, contributing to higher greenhouse gas emissions and negatively affecting wildlife behavior. Additionally, starting in 2030, Polish law (Journal of Laws 2024, item 1558) will prohibit the use of genetically modified (GM) feed materials, such as soybean products imported from the USA, Brazil, and Argentina. This compels the search for alternative sources of protein and energy for the poultry industry, which currently relies heavily on GM feed materials. As a key player in the EU poultry sector, Poland seeks to increase the use of rapeseed products and legumes in poultry diets. However, the yield of these crops is highly dependent on environmental conditions, particularly water availability.

The project proposes an alternative solution aligned with the principles of environmentally sustainable production and the 4R strategy: Reduce, Reuse, Recycle, and Recover energy from waste. Insects are a natural part of wild bird diets, and their rearing uses organic materials unsuitable for human consumption. The water content in discarded vegetables and fruits is sufficient to ensure rapid larval growth without the need for additional drinking water. *Hermetia illucens* larvae (black soldier fly, BSF) have significant market potential due to their short developmental cycle and ability to convert low-value substrates into nutrient-rich biomass. Preliminary studies have shown that BSF larval fat is rich in medium-chain fatty acids, including lauric acid, known for its health-promoting properties. BSF fat may effectively replace GM soybean oil in broiler and turkey diets. Unfortunately, limited knowledge about the potential welfare risks associated with skeletal development, gut health, physiological and immune responses, and the energy density of BSF fat hampers its broader application in animal nutrition.

### **Project Objective:**

The project will include two independent experiments aimed at: I) Assessing potential risks associated with the use of BSF larval fat in laying hen diets, focusing on skeletal development as a welfare indicator, along with physiological and immunological responses and changes in the gastrointestinal microecosystem in the context of bird health; II) Evaluating the potential effects of BSF fat on laying performance, nutrient utilization, and egg quality.

### **Expected Outcomes:**

The project will significantly expand knowledge on the use of insects in laying hen nutrition as an alternative to GM and environmentally harmful feed materials, supporting sustainable animal production. The anticipated positive effects of BSF larval fat on bird welfare, gut microbiota, and physiological and immune responses may help define this fat as a functional feed ingredient. Project results will contribute to the development of domestic capacities for producing alternative energy sources from insect biomass, thereby reducing reliance on imported feed materials.